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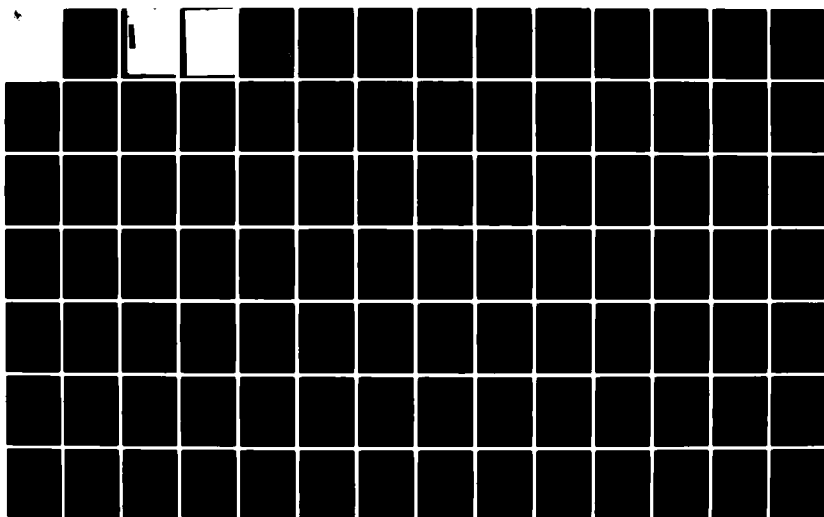
GUIDE TO CANADIAN AEROSPACE RELATED INDUSTRIES(U) AIR
FORCE SYSTEMS COMMAND WASHINGTON DC
R L MCKENNEY ET AL. JAN 83 AFSC-TR-83-001

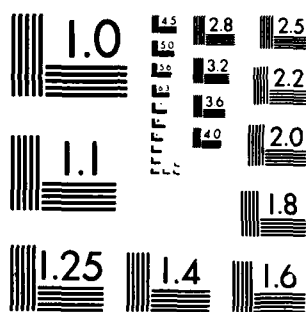
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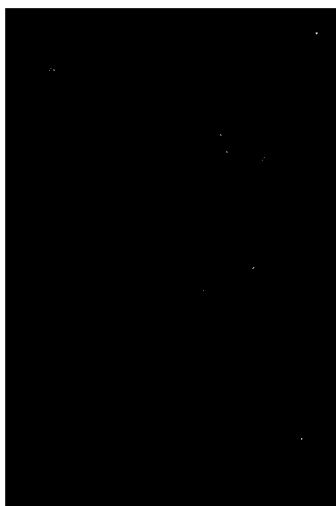
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P R E F A C E

This Guide to Canadian Aerospace Related Industries presents a compilation of descriptive data on 132 companies located in Canada that have expressed interest in doing business with the United States Air Force. This Guide has been prepared with three main objectives in mind:

- a. To encourage Air Force Systems Command Project Officers to take advantage of the industrial capability of Canada.
- b. To engender interest within AFSC for participating in the US/Canada Defense Production and Development Sharing Programs.
- c. To encourage Canadian aerospace industry to take a more active role in presenting their capabilities to the USAF.

The companies profiled in this Guide represent a cross-section of Canadian industry and research facilities with capabilities that may be of interest to the USAF research & development and logistics communities. There are numerous guides to Canadian industry published in Canada by the Canadian Government and by various trade associations. A reference list of these publications is included in Section I. This second USAF Guide contains one hundred and one of those companies appearing in the first edition, AFSC-TR-81-48 (AD-A108640), plus thirty-one companies not previously listed.

Comments and/or suggestions concerning the format or content of this Guide are solicited. Questions concerning the US/Canada Defense Production and Development Sharing Program or the subject matter of this Guide should be directed to Lt Col Donald J Pearson, or Dr Robert L McKenney, Jr., AFSC Liaison Office; 110 O'Connor St, Suite #202; Ottawa, Ontario, Canada; K1P 5M9. Telephone contact can be made at (613) 593-7725 (commercial), or Autovon 676-6523.



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Section I
I N T R O D U C T I O N

Section I

I N T R O D U C T I O N

One of the functions of the Air Force Systems Command Liaison Office in Ottawa is to stay current on Canadian industrial capabilities and trends. This is accomplished primarily through visits to companies and personal and/or telephone interviews, followed by the completion of standard format company profile questionnaires. Additional information and leads to new companies are obtained through contacts with the Departments of External Affairs, Regional & Industrial Expansion, Supply & Services, and the Canadian Commercial Corporation. This Guide represents the culmination of over a year's work involving extensive interviews and telephone contacts from the Maritimes to the most western provinces.

As would be expected for a modern, industrialized country, Canada's industrial base is very diversified. Their industries typically include:

- | | |
|--------------------|-----------------|
| • Aerospace | • Fishing |
| • Chemical | • Medical |
| • Chemical Defense | • Energy |
| • Communications | • Metal Working |
| • Electronics | • Ordnance |
| • Environmental | • Petroleum |
| | • Space |

Canada has a very large industrial commitment to the aerospace, communications, electronics, and space areas. As one might expect, these are primarily concentrated in the Ontario-Quebec corridor, extending from Windsor through Toronto and Ottawa and terminating in Montreal. Other locations with expanding industrial bases are the Winnipeg (Manitoba), Edmonton-Calgary (Alberta), and Vancouver (British Columbia) areas. Substantial contributions to the Canadian industrial capability are also afforded by the Quebec City (Quebec) and Halifax (Nova Scotia) areas.

As in the first edition, this second edition does not attempt to group companies into specific categories such as aerospace or electronics. It simply associates their specific capability keywords with twenty general categories (See Section III). Neither does this Guide attempt to differentiate R&D capabilities from pure product lines. While most companies have product lines, some are very R&D oriented and seem eager to engage in R&D contracts. For those companies that appear primarily product oriented, it is assumed that they do have an R&D capability within their area of expertise.

Section II of this Guide presents Canadian industrial capabilities as a compilation of individual company profiles. The general format for the company profiles include the following subsections: NAME, ADDRESS, CONTACT POINT, AVERAGE WORK FORCE, GROSS SALES, PLANT SIZE, EQUIPMENT, EXPERIENCE, AND KEYWORDS.

The KEYWORD subsection begins with general category names, each preceded by its identifying number (e.g., 1=Aircraft, 2=Armament20=Miscellaneous), followed by specific capability keywords. Each of the latter words is followed by a number or series of numbers that refer to the appropriate general category with which the word is associated.

Section III (Company Keyword Index) relates company capabilities in the form of keywords to a series of twenty general category areas. The specific keywords are presented in columnar form in alphabetical order. The second column lists the identifying numbers associated with the general categories. The third column lists the company, in code form, associated with the keyword. The company code cross index forms Section IV.

Canadian trade publications that can be used to supplement this Guide, thereby providing a more complete listing of companies are listed below:

- Canadian Defense Products Guide, published by the Canadian Department of Industry, Trade and Commerce.
- Canada in the World of Electronics, 1982, distributed by the Canadian Department of Industry, Trade and Commerce.
- Canada in Space, prepared by the Interdepartmental Committee on Space, Ministry of State for Science and Technology.
- Canada's Aerospace Industry: A Capability Guide - 1982, produced by Creative Communications, a division of MacLean Hunter Ltd in cooperation with the Air Industries Association of Canada, the Canadian Department of Industry, Trade and Commerce, and Aerospace Canada Magazine.
- The CATALOG, Nov 1982, publication of the Canadian Advanced Technology Association.

For the most part, Canada's high-technology industrial capability is on an even par with that of the United States, but generally on a somewhat smaller scale. It may certainly be considered another source base for USAF R&D procurements, as well as for commodity buys. It is hoped that this Guide will help provide the user with some insight into the Canadian system and encourage its use if deemed appropriate. Increased competition and "new blood" can only reduce USAF procurement costs and hopefully lead to better products.

Section II

COMPANY PROFILES

COMPANY: A.E.I. TELECOMMUNICATIONS (Canada) Ltd

CODE: AEI

ADDRESS: 419 Notre Dame Ave
Winnipeg, Manitoba, Canada R3B 1R3

CONTACT: Mr. R E Day, Sales Manager - (204) 942-7221

HISTORY: AEI is a Canadian company established over 55 years ago. They are a wholly owned subsidiary of the General Electric Company of England. There are no other Canadian locations.

CAPABILITY: AEI is involved in the engineering, manufacturing, distribution and installation of telecommunication switching systems. They have supplied major local and toll switching systems for Canadian metropolitan areas, as well as smaller dial offices, PABX systems, and peripheral equipment.

AVERAGE WORK FORCE: Engineers - 10
Others - 122

GROSS SALES: Per Annum - \$7-8M

PLANT SIZE: 40,000 sq ft

EQUIPMENT: The company has the following equipment available for use on projects:

- . Laboratory Equipment: SWPT 6800 Computer Software System, Soroc Software Programming (Development) System, etc.
- . Machinery Equipment: Ragen 750 Automatic Self Programmable PC Board Assembly System, Econopak 229 Automatic PC Board Soldering System, etc.
- . Test Facilities: Environmental Chamber, adjustable from 0 to 70°C (32.0 - 158°F) for burn-in testing of various integrated circuits (PC boards).

EXPERIENCE: AEI is involved in the production of Automatic Number Identification (ANI) systems and 911 Emergency Reporting Systems for world-wide markets. They have over 20 years of experience with ANI systems manufacture and have over 2 million lines of ANI equipment installed in North America and other world-wide markets.

KEYWORDS: 5=Communications; Telecommunications=5; Switching=5;
PABX Systems=5; Peripheral Equipment=5;
Automatic Number Identification Systems=5; Telephone Gear=5.

REVISED: Sep 82.

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COMPANY: AEL MICROTREL Ltd
Manutronics Division

CODE: MAN

ADDRESS: 100 Strowger Blvd
Brockville, Ontario, Canada K6V 5W8

CONTACT: Mr. E R MacIntosh, Marketing & Sales Manager - (613) 342-6621

HISTORY: In 1980, the Manutronics Division of AEL Microtel Ltd, a Canadian owned company, was established to market custom electronic manufacturing services. A percentage of the total resources currently available to Manutronics will be expanded to meet future needs. Microtel, Canada's second largest manufacturer of telecommunications equipment is a wholly owned subsidiary of British Columbia Telephone Company.

CAPABILITY: Microtel's resources are available in the areas of 'B blank designs, layout & fabrication, PWC assembly & test, automatic backplane wiring, computerized wire verification, hybrid circuit assembly & test, and complete product development and assembly, etc. Manutronics offers Microtel's production expertise and facilities on a contract basis to industry to meet specialized needs such as - Research & Development, System Consulting & Custom Design, System Design & Engineering, Custom Engineering, Specialized Training, and Product Representation.

AVERAGE WORK FORCE: Total - 1200

GROSS SALES: Manutronics - 1983 - \$6M (projected)
Manutronics - 1984 - \$12M (projected)

PLANT SIZE: 473,000 sq ft

KEYWORDS: 7=Electronics; 12=Machining; 20=Miscellaneous;
Fabrication/Assembly/Test=7; PC Boards=7; Automated Backplane Wiring=7;
Printed Wiring Card=7; Sheet Metal=12; Hybrid Assembly=7; Plastic Molding=12;
Reed Capsule=20; Relays=7; Coils=7; Custom Design & Development=7.

REVISED: Sep 82.

COMPANY: AERO MACHINING Ltd

CODE: AER

ADDRESS: 5411 Industrial Blvd
Montreal-North, Quebec, Canada H1G 3H7

CONTACT: Mr. Gerard Beausoleil - (514) 324-4260

HISTORY: Aero Machining Ltd is a small machining company incorporated in 1963 in the Province of Quebec. There are no other Canadian or US locations.

CAPABILITY: Aero Machining Ltd provides services in tool design, production, maintenance, sub-assemblies, die and mold development, and fabrication. They specialize in general machining, three axis profiling or four spindle profilers, high tensiles, titanium, and D-6-AC material. Their quality control is governed by the "Aero Machining Ltd" quality control manual in accordance with MIL-Q-9858A and MIL-C-45662A. The company is approved for the manufacture of aircraft hydraulic servos, landing gear components, and missile and airframe machined parts. Accumulative quality control records are kept to provide necessary traceability of inspection data. Their quality control policy is approved to meet the requirements of various US DOD QC specifications, as well as the Canadian DND 1015 specification, for the manufacture of aircraft mechanical parts and mechanical and hydraulic assemblies.

AVERAGE WORK FORCE: Total - 120

GROSS SALES: 1980 - \$2.75M

PLANT SIZE: 20,000 sq ft

EQUIPMENT: Their equipment includes lathes, borers, milling machines, profilers, drills, honing machines, and grinders. They have a hydraulic assembly and test facility for all hydraulic assemblies and parts manufactured by the company. They are currently bringing their NC capability up to speed.

EXPERIENCE: Aero principal customers include Air Canada, Canadair Ltd, Canadian Marconi, Douglas Aircraft, GE, United Aircraft, DeHavilland, Grumman Aircraft, and Canadian Vickers Ltd.

KEYWORDS: 1=Aircraft; 12=Machining; 13=Missiles; Titanium=12; Tooling=12; Die Fabrication=12; Hydraulic Servos=1, 12; Landing Gear Components=1, 12; Airframe Parts=1, 12; Missile Parts=12, 13.

REVISED: Jun 82.

COMPANY: ALBERTA RESEARCH COUNCIL

CODE: ARC

ADDRESS: Executive Offices
7th Floor, Terrace Plaza
4445 Calgary Trail South
Edmonton, Alberta, Canada T6H 5R7

CONTACT: Ms. Dorothy M Hollands, Secretary of Council - (403) 438-5050

HISTORY: The Alberta Research Council is a provincial Crown Corporation founded in 1921 to advise the Alberta Government on scientific affairs and to promote the economic growth of Alberta through scientific and engineering research. It has grown into an organization of 500 employees with offices and laboratories in Edmonton, Calgary, Red Deer, Nisku, Devon and Lethbridge.

CAPABILITY: The Research Council has established in its Long Range Plan five major areas of research - industrial and engineering research and assistance, oil sands, coal, natural resources, and frontier sciences. The industrial and engineering research program includes research activities in transportation, surface water engineering, projects in forest products, electricity, alternate energy and energy conservation. It also runs a gasoline and oil testing laboratory and provides short-term advisory and technical services to manufacturing companies in Alberta. Oil Sands Research includes geology studies, heavy oil cracking, in-situ recovery. Coal research includes geology studies, liquefaction, pyrolysis, coal property definition, and gasification. Natural resources research activities include geological survey, soils surveys, groundwater, and atmospheric sciences. For a major weather modification project, the Research Council developed a unique digital weather radar system, a copy of which it sold to Brazil. Frontier science projects include research into new catalysts, electro-organic reactions, low temperature biology, and enzyme design studies using genetic engineering techniques.

AVERAGE WORK FORCE: Scientists, Engineers, & Research Technicians

GROSS SALES: The Research Council operates on a \$38 million budget in 1982-83, half of which comes in the form of an annual provincial grant, and the other half which comes from contracts with provincial government departments and private industry.

PLANT SIZE: 279,000 ft² (26,000 m²) (1982)
505,250 ft² (47,000 m²) (1984)
580,500 ft² (54,000 m²) (1987)

EQUIPMENT: The Research Council has a range of equipment for carrying out studies on oil sands and coal technology from fundamental science to benchscale pilot work; sophisticated chemical analytical instruments; distributed computing equipment. Its digital weather radar system uses computer program interactive graphics to produce displays of vertical cross sections from digital weather radar data archived on magnetic tape. The overall display allows the analyst to examine radar echoes. These data are used for storm analysis, hail description, flood prediction, aircraft-storm interaction or avoidance and spacecraft re-entry.

EXPERIENCE: Weather Modification - Contract with Alberta Agriculture.
 Flood Forecasting - Contract with Alberta Environment.
 Radar Development - Contract with Environmental Research and Development (US).
 Digital Radar Data Processing - Contract with Fundacao Educacional de Bauru, Brazil.
 Satellite/Radar Rainfall Measurement - Contract with Canadian Atmospheric Environment Service.

KEYWORDS: 4=Chemistry; 8=Energy; 9=Environment; 15=Radar; 17=Software Services; 18=Space Systems; 19=Testing/Test Equipment; 20=Miscellaneous; Meteorology=15; Digital Data Processing=9, 15; Computer Graphics=9; Statistical Analysis=9; Weather Forecasting=9; Cloud Seeding=9; Cloud Physics=9; Weather Modification=9; Convective Storms=9; Hydrometeorology=9; Precipitation Measurement=9, 15, 18; Flood Forecasting=9; Air Pollution=9; Numerical Modelling=9, 17; Biology=20; Microbiology=20; Chemical Processing=4; Industrial Engineering=20; Products Testing=19; Materials Testing=19; Transportation=20; Oil Sands=8; Coal Liquefaction=8; Coal Pyrolysis=8; Geology=8, 9; Soils=8, 9; Water=8, 9; Ground Water=8, 9; Surface Water=8, 9.

REVISED: Jun 82.

COMPANY: AMTEK MANAGEMENT Inc

CODE: AMI

ADDRESS: 120 Holland Ave
Ottawa, Ontario, Canada K1Y 0X6

CONTACT: Mr. L E McClare, VP and Technical Director - (613) 728-1244

HISTORY: AMTEK was formed in 1981 as a wholly owned Canadian company. It was formed to provide services to governments and industries on Integrated Logistic Support (ILS); Automatic Test Equipment; and contract and program management.

CAPABILITY: AMTEK is a leader in Canada in the field of integrated logistic support having supplied services to Canada's major acquisition programs - CP140 Aurora purchased from Lockheed, CF18 from McDonnell-Douglas, and the Canadian Patrol Frigate program. ILS development services have been provided to DND, Litton Systems Ltd, Canadian Marconi, and Leigh Instruments Ltd.

The company has experience in Logistic Support Analysis (MIL-STD-1388) and Level of Repair Analysis (MIL-1390), and the USAF ORLA (AFSCM/AFLCM 800-4) maintenance plan and other element development. This experience has been accumulated working within the US military community at such facilities as Lockheed, Burbank and McDonnell-Douglas, St Louis.

AMTEK has provided field service support to the Canadian government for Automatic Test Equipment. The company also provides training in electronics, ATE, procurement and contract management.

AVERAGE WORK FORCE: 15 (Engineers & Technologists)

GROSS SALES: 1981 - \$920K

PLANT SIZE: 4,500 sq ft

EXPERIENCE: AMTEK clientele includes Department of National Defense, Department of Supply and Services, Royal New Zealand Air Force, Canadian Marconi, Litton Systems Ltd, Bristol Aerospace Ltd, Leigh Instruments Ltd, and Lockheed Aircraft.

KEYWORDS: 1=Aircraft; 3=Avionics; 7=Electronics; 19=Testing/Test Equipment; 20=Miscellaneous; Integrated Logistic Support=1, 3, 20; ILS=1, 3, 20; Program Management=20; Logistic Support Analysis=20; Level of Repair Analysis=20; Training=7; Automatic Test Equipment=7; 19; Contract Management=20.

REVISED: Aug 82.

COMPANY: ANATEK ELECTRONICS Ltd

CODE: ANA

ADDRESS: 240 Brooksbank Ave
North Vancouver, British Columbia, Canada V7J 2C1

CONTACT: Mr. T C Gould, Marketing Manager - (604) 980-7061

HISTORY: Anatek is a Canadian owned company incorporated in 1969. It is active in both the Canadian and US electronics markets. The company operates with two divisions, Power Supply & Microcircuit.

CAPABILITY: Anatek's expertise is divided into divisions:

Power Supply Division - Anatek has been building quality custom and laboratory power supplies since 1969. Their standard products include 50 and 120 watt linear laboratory power supplies, and a series of 300 watt switching laboratory power supplies.

Microcircuit Division - In order to maintain a competitive stance in the power supply market, Anatek developed their own thick film microcircuit capability. The microcircuit facility, established in 1976 has recently been renovated to include clean-room facilities to improve printing and wire-bonding yields and reliability.

AVERAGE WORK FORCE: Power Supply Division - 32
Microcircuit Division - 14

GROSS SALES: \$2.0M (Power Supplies)
\$1.5M (Projected for Microcircuits in 1982)

PLANT SIZE: 10,000 sq ft

EXPERIENCE: Anatek's major customers for power supplies have been NCR, Burroughs Business Machines Ltd, Farinon Canada Ltd, and Plessey Canada Ltd. Custom microcircuits have been supplied to GTE Lenkurt Electric (Canada) Ltd, NCR, and a host of telecommunications and computer peripheral manufacturers. Anatek's future R&D efforts will be directed at the RF device and military market.

KEYWORDS: 7=Electronics; Power Supplies=7; Linear Power Supplies=7; Switching Power Supplies=7; Thick Film Microcircuits=7; PC Board Design=7; Thick Film Hybrid Parts=7.

REVISED: Oct 82.

COMPANY: C. V. W. ARMSTRONG CONSULTANTS Ltd

CODE: ACL

ADDRESS: 350 Sparks St, Suite #907
Ottawa, Ontario, Canada K1R 7S8

US OFFICE
8247 Lewiston
San Antonio, Texas 78250

CONTACT: Mr. Cedrick V W Armstrong, President - (613)-563-0210

HISTORY: The company was incorporated in 1979 and has one Canadian office and one US Office. It is Canadian owned and, is in the process of making the transition from a part-time to a full-time operation.

CAPABILITY: The company's technical capability is in research and development and systems engineering related to computer systems.

AVERAGE WORK FORCE: PhD - 1
Eng - 1
Others (Programmers and Technicians available)

GROSS SALES: 1981 - \$18K (part-time operation)
1982 - \$110,000 (forecast, full-time)

PLANT SIZE: Small Office

EQUIPMENT: One word-processing & communications terminal and processor.

EXPERIENCE: Major projects have included the evaluation of specialized computer systems, a study of the US Advanced Onboard Signal Processor program, and research into radar plot-to-track correlation. This work has been with the Communications Research Center, Canadian Department of Communications.

KEYWORDS: 6=Computers; 10=Image Processing & Optics; 15=Radar;
17=Software Services; Consulting=6; Special Purpose Processors=6;
Signal Processing=6, 15; Image Processing=6, 10; Multiprocessor Systems=6;
Firmware Design=6; Microprogramming=17.

REVISED: MAY 82.

COMPANY: ATHABASCA RESEARCH CORPORATION Ltd

CODE: ATH

ADDRESS: 11210-143 St
Edmonton, Alberta, Canada T5M 1V5

CONTACT: Mr. T E Adams, President - (403) 452-0924

HISTORY: Athabasca Research Corp Ltd is a Canadian owned high technology company with one subsidiary in Canada - Tanknology Canada Ltd, and one company currently being formed in the US. The company was incorporated in early 1976 primarily to provide specialized services in the design of instruments and systems for air quality monitoring, meteorological measurements, and data acquisition and control systems for the petroleum industry and government agencies.

CAPABILITY: Athabasca Research is actively engaged in the provision of multi-disciplined scientific and engineering systems and services. Their background experience includes the manufacture of geophones and recording seismographs for oil exploration purposes. A significant portion of their present activities are environment oriented; including research, data collection and interpretation, and the development and manufacture of associated instrumentation. They are active in the area of environmental monitoring program management and take responsibility for all aspects including hardware specification, procurement, operation and maintenance, and data reduction. They provide turnkey operation of complete environmental and meteorological monitoring systems.

Athabasca's products include:

- . Weather radar data processing systems
- . Ambient air quality monitoring and meteorological systems
- . Ultraviolet spectrometers
- . Meteorological instruments
- . Pibal Tracking Systems
- . Automated suspended sediment samplers
- . Geophones and seismographs
- . Leak detection system for underground petroleum products storage tanks
- . Laser related devices

Their weather radar system correlates radar reflections from storms with antenna azimuth and elevation positions and reflections intensities to derive a comprehensive picture of the storm and its characteristics. The system includes a conventional S or C band radar, the interfacing electronics hardware package, and a PDP 11/34 computer. It features a strong interactive graphics capability.

Their ambient air quality monitoring systems generally include monitoring trailers equipped with instrument towers, data acquisition and computing terminals along with gas analysers, meteorological sensors, and peripheral devices. These systems are currently designed to detect SO₂, NO₂, NO, NO_x, O₃, H₂S, CO and CO₂ to less than 10ppb levels. The basis for detection is chemiluminescence, fluorescence, UV and IR absorption. Athabasca's meteorological instruments include a Windflo anemometer, Comprop anemometer (composite pitch propeller) for turbulence measurements, atmospheric flux

monitor, and differential air temperature system. The automated suspended sediment sampler is designed to take water samples for later analysis. The device can either sample continuously (at preselected intervals) or in a "rain gauge" mode. In the latter mode, it remains dormant, consuming almost no power until it is activated by a tipping bucket type of rain gauge.

Their Pibal tracking system is used for the determination of wind speed and direction and/or temperature, at incrementally increasing altitudes. It basically consists of two theodolites on a 1000 ft base line tracking a balloon, each instrument being equipped with shaft encoders that measure azimuth and elevation angles. These data are conveyed to a data acquisition system (Athabasca designed) which is programmed to calculate and print out the altitude, wind speed and direction, downwind position, and temperature.

The Athabasca leak detection system utilizes the principle of vacuum induction of air bubbles to detect wall perforations in underground/enclosed storage tanks for petroleum products. The system consists of a monitoring van equipped with appropriate instrumentation and vacuum equipment and hydrophone probe that identifies the distinctive bubble signature induced by the reduced pressure, and simultaneously detects the presence of water. The test method is fast, economically acceptable and is initially evaluated by industry as being superior to other methods currently in use. The system detects pinhole size leaks as well as larger ones, and is not subject to most of the drawbacks of the other leak test procedures.

They have conceived, designed and are currently negotiating a contract with the Canadian Department of National Defense to develop a Tactical Target Scoring System. The system can accurately measure the impact position of air delivered ordnance, e.g., bombs, rockets, missiles, etc., on tactical test ranges. It utilizes a unique sensing and data acquisition system that can interpret and transmit objective impact information to the range control facility. The system is independent of visibility restrictions, lighting conditions and can detect the munition's impact with or without an accompanying blast or marking charge. It is self-contained, requiring no external power sources, can be remotely activated or deactivated, and conveys information by either conventional RF link or via a data collection platform.

Finally, they have demonstrated expertise in laser technology. Their Lasalign (or Lasaline) product expands a laser beam in one direction by an optical method to form a line that can be used as a reference line. They have also developed and manufactured a laser extinction-type particulate monitor. This device detects particulate matter in air and can give an accurate concentration. It is particularly useful in pollution monitoring, e.g., particulates in stack emissions.

AVERAGE WORK FORCE: Total - 12

GROSS SALES: 1980 - \$1M

PLANT SIZE: 7,000 sq ft

EXPERIENCE: Athabasca Research has experience with both the Alberta and Canadian Governments, Universities and Canadian industry. Industrial clients include Petro Canada, Imperial Oil Company, Shell Canada Ltd, Amoco Canada

Ltd, Texaco Canada Ltd, Gulf Oil Company, Dow Chemical, Sheritt Gordon Mines, Bell and Howell Canada Ltd, and Alberta Government Telephones. They have no experience with the USAF, but are interested in working with the USAF in the future.

KEYWORDS: 7=Electronics; 8=Energy; 9=Environment; 11=Lasers; 15=Radar; 17=Software Services; 19=Testing/Test Equipment; 20=Miscellaneous; Geophones 7, 8; Recording Seismographs=7, 8; Acoustic Sensing=7; Data Acquisition=7, 9; Geophysics=7, 8; Environmental Sensors=7, 9; Meteorological Stations=9, 20; Meteorological Equipment=9, 20; Environmental Analysis=9; Environmental Forecasting=9; Leak Detection System=9, 19; Pollution Sensing=9, 19; Pollution Analysis=9; Weather Radar=9; Trace Gas Detection=9, 19; Laser Optics=11; Weather=15; Environmental Programs=17; Instrumentation=9, 19; Monitoring=9; Ultraviolet Spectrometer=19, 10; Wind Speed Determination=9; Wind Direction=9; Underground Storage Tanks=9, 19; Tactical Target Scoring System=19; Range Instrumentation=19; Ordnance Impact Position=19.

REVISED: Jul 82.

COMPANY: ATLANTIS FLIGHT RESEARCH Inc

CODE: AFR

ADDRESS: 3924 Chesswood Drive
Downsview, Ontario, Canada M3J 2W6

CONTACT: Mr. Dale Simmons, General Manager - (416) 630-8611

HISTORY: A wholly owned Canadian company incorporated in 1978, there are no other Canadian divisions or US subsidiaries.

CAPABILITY: Atlantis is involved in the design, development and manufacture of test equipment primarily in support of avionics systems found on civil aircraft. In addition to test equipment, they have developed a number of custom electronic training aids which are applicable but not limited to the aerospace industry.

The avionics test equipment product line is comprised of a number of self-contained bench test units from various series of avionics systems. Test equipment for radio/radar altimeters, VHF navigation systems, VHF and HF transceivers, audio and passenger address amplifiers, cockpit voice recorders, flight data recorders and other systems have been developed to date and are now in service. In addition to the line of bench testers, Atlantis has produced units to suit customer requirements for testing on-aircraft equipment. For example, Engine Component Simulator and Parameter Readout units have been built to provide a fast and reliable check of engine-related wiring integrity and indicator accuracies for the Canadair Challenger aircraft.

Their Animated System Trainers are independent microprocessor controlled displays which provide a real-time simulation of various aircraft subsystems. For example, AST boards have been delivered to Canadair for their Challenger aircraft ignition/start, electrical, hydraulic and bleed air systems. ASTs may be configured to suit individual training requirements.

<u>AVERAGE WORK FORCE:</u>	PhDs	- 1
	MSs	- 2
	Mfg	- 5
	Others	- 7

<u>GROSS SALES:</u>	1978 - \$ 45K
	1979 - \$180K
	1980 - \$400K
	1981 - \$750K

PLANT SIZE: 2,000 sq ft

EXPERIENCE: Atlantis has supplied equipment to the Canadian Government, original equipment manufacturers (e.g., Canadair - Challenger wide-bodied business jet, DeHavilland), the corporate aviation sector, and major avionics facilities (mainly in support of airlines). Current US sales have been mainly commercial with no sales to the USAF. They are interested in expanding their business to include the US military.

KEYWORDS: 1=Aircraft; 3=Avionics; 19=Testing/Test Equipment;
Test Equipment=3; Training Aids=1; Radio/Radar Altimeters=19;
VHF Navigation Systems=19; VHF Transceivers=19; HF Transceivers=19;
Flight Data Recorders=19; Cockpit Voice Recorders=19;
Engine Component Simulator=19; Animated System Trainers=1, 19.

REVISED: May 82.

COMPANY: AVTECH ELECTROSYSTEMS Ltd

CODE: AVT

ADDRESS: (Mailing)

P. O. Box 5611, Station F
Ottawa, Ontario, Canada K2C 3M1

(Location)

15 Grenfell Crescent, Suite #205
Nepean, Ontario, Canada K2G 0G3

CONTACT: Dr. W J Chudobiak, President - (613) 226-5772

HISTORY: Avtech Electrosystems Ltd is a small, private Canadian, high technology company incorporated in 1975. There are no other branches or affiliates in Canada or the US. The company is represented in France, W. Germany, Japan, Austria, the UK, and the Benelux countries.

CAPABILITY: Avtech was established for the purpose of designing and marketing nanosecond waveform instrumentation. Since its start, it has become recognized as a leading supplier of nanosecond waveform generators and accessories with over 90 models. Their product line includes pulse generators, impulse generators, monocycle generators, pulse amplifiers, transformers, power splitters, bias insertion units, and scope probes.

The all solid-state waveform generators are available as stand alone lab instruments, or as miniature DC powered modules. The amplitude and the voltage rate of rise for some of their units are at least an order of magnitude higher than those provided by standard tunnel diode pulse generators. The combination of some aspects of microwave integrated circuit technology with ultra-fast semiconductor device switching technology (including SRD, hot carrier diodes, avalanche, VMOS and bipolar switches), has yielded 100 psec rise and fall times, PRF beyond 250 MHz, amplitude to 350 volts, peak currents to 100 amperes, and single cycles of RF to 1500 MHz. They can design, develop and build to customer requirements.

Avtech's linear pulse amplifiers are designed to be used to increase the peak output level of laboratory pulse generators to levels as high as 40 volts, by providing voltage gains of approximately 2. The Avtech inverting and impedance transformers are designed to be used with general purpose laboratory pulse generators, with subnanosecond risetime pulse generators and circuits, and other units. They provide inverted output pulse with a magnitude equal to the input signal magnitude, and can match to other impedance levels or can obtain higher output currents.

Avtech's power splitters provide two outputs which are either both in phase (non-inverted) with the input signal, or with one output non-inverted and with one inverted. They are designed for use with nanosecond speed laboratory pulse generators, with CW signals, or with other units to frequencies as high as 1.0 GHz. Their bias insertion unit is designed for both CW and subnanosecond risetime baseband pulse applications. The scope probe was designed to be used with a 50 ohm sampling oscilloscope, to allow probing of test points in microstrip structures and in discrete RF circuits and subnanosecond pulse circuits, operating at frequencies as high as 5 GHz and with risetimes as low as 100 psec.

AVERAGE WORK FORCE: Total - 4

GROSS SALES: 1981 - \$320K
1982 - \$450K

PLANT SIZE: 3,000 sq ft

EXPERIENCE: Approximately 80% of Avtech's sales are export. Their products have been supplied worldwide to companies, universities and government agencies, e.g., USAF, Harry Diamond Laboratories, Los Alamos Scientific Laboratories, Hewlett Packard, Honeywell, Hughes Aircraft, Lawrence Livermore Laboratories, Martin Marietta, Bell Northern Research, etc.

KEYWORDS: 7=Electronics; Waveform Instrumentation=7; Waveform Generators=7; Nanosecond=7; High Speed Pulsers=7; Pulse Generators=7; Impulse Generators=7; Monocycle Generators=7; Pulse Amplifiers=7; Transformers=7; Solid State=7; Power Splitters=7; Bias Insertion Units=7; Scope Probes=7; Stand Alone Lab Instrumentation=7; DC Powered Modules=7; Linear Pulse Amplifiers=7; Inverting Transformers=7; Impedance Transformers=7.

REVISED: Jul 82.

COMPANY: BAKER ENGINEERING ENTERPRISES Ltd

CODE: BEE

ADDRESS: 9620-27 Ave
Edmonton, Alberta, Canada T6N 1B2

CONTACT: Mr. Len Friedenber, President - (403) 463-0922

HISTORY: Baker Engineering is a Canadian owned company incorporated in 1973 with a US subsidiary (BEE Agra Corp) located in Denver, Colorado. The company's original aims were research, design and manufacture of electronic instrumentation, specifically for use in the agricultural industry.

CAPABILITY: Engineering expertise at Baker Engineering is directed towards the areas of mechanical electrical transducer design, analog & digital monitoring and control circuitry, microprocessor applications to monitoring control problems, and electro-mechanical servo component design. Baker Engineering product line includes a combined efficiency monitor, and liquid sprayer application monitor. Many other agriculturally oriented monitors are in the Baker Engineering product line. A second general area of product development was toward an electric fence controller that operates on existing fences with wood posts without the requirements for wire insulators and grass/brush free status. Particular attention is paid to production engineering & testing, and quality control with appropriate documentation.

AVERAGE WORK FORCE: Engineers - 7

GROSS SALES: \$1 - 1.5M (past few years)

PLANT SIZE: 12,600 sq ft

EQUIPMENT: In-house equipment to insure quality productivity includes computer controlled printed circuit board drilling; transformer and coil winding; printed circuit wave soldering facility; sheet metal shearing, punching, and forming; and a thermoplastic injection molding facility.

EXPERIENCE: During the past two years, about 10 to 15% of sales have been to the US, primarily through their US affiliate. They have no experience with the US DOD.

KEYWORDS: 7=Electronics; Measurement Systems=7; Control Systems=7; Transducer Design=7; Analog=7; Digital=7; Monitoring Systems=7.

REVISED: Sep 82.

COMPANY: BALLARD RESEARCH Inc

CODE: BRI

ADDRESS: 1164 - 15th Street West
North Vancouver, British Columbia, Canada V7P 1M9

CONTACT: Dr Geoffrey E H Ballard, President - (604) 986-4104

HISTORY: Ballard Research Inc (BRI) was incorporated in 1979. The key group of scientists and engineers at BRI have been together since 1976. The Ballard group of companies (Ballard Technologies Corp, Ballard Research Inc, and Ballard Engineering) are privately owned.

CAPABILITY: Ballard Research Inc offers complete services in lithium, high energy density secondary and primary batteries, research, development, design, production equipment, and pilot plant operations.

AVERAGE WORK FORCE:

PhDs	- 7
Prof Engs	- 5
Technologists	- 7

GROSS SALES:

1980	- \$0.8M
1981	- \$1.2M
1982	- \$2.0M
1983	- \$2.8M (Projected)

PLANT SIZE: 12,000 sq ft (18,000 sq ft planned for 1983)

EQUIPMENT: Hitachi S450 Scanning Electron Microscope; Kevex 7000 Energy Dispersive X-Ray Analysis; 3 VAC Controlled Atmosphere Gloveboxes; HP 5830A Gas Chromatograph; Cary 219 UV Spectrophotometer; Par 370 Electrochemical System; DG MP/200 MicroNova Computer; Pope Distillation Equipment; 2 Fume Hoods; Vacuum Ovens; Balances; Computer Controlled Cell Cycler; Tektronix 465B Oscilloscope; IMS Development System c/w LSI ADM 32 Terminal; Tektronix 308 Data Analyser; Telequipment D67A Oscilloscope; Wavetek 20 MHz Pulse Generator; HP 6256B DC Power Supplies; Bridgeport Series I 2HP Milling Machine; Maximat 10" Lathe; Yam 14" lathe; IMA 12 Speed Drilling Machine; Sharp Power Hacksaw; General Bandsaw; Jet 4 Speed Drill press; Wissota 6" Bench Grinder; Tri Star 230 ac/dc Welder; Automatic Laser Welding Machine; Automatic fill and Seal Machine; Duff Norton 100 Ton Hydraulic Press; Jet 5 Ton Hydraulic Press; Linde Plasma Needle Arc Welder; Unitek Spot Welding Equipment; Cargocaire HC 3000 Dehumidifier; Coherent Everlase 275 Watt Laser; Data General S/140 Computer w/12 terminals Dasher 200, Plotter, Document Printer and Line Printer.

EXPERIENCE: Ballard's experience includes - complete design and build of battery manufacturing module for 5000 cells per day for People's Republic of China; research, design and development of 9 volt, ten year life lithium sulfur dioxide primary smoke detector battery for Fyrnetics Inc of Elgin, Illinois; research studies in secondary lithium battery systems for Shell Canada Ltd; and also on-going proprietary research for Standard Oil Co of Indiana.

KEYWORDS: 4=Chemistry; 8=Energy; Battery=4, 8; Lithium=4, 8;
High Energy Density=4, 8; Anode=4, 8; Cathode=4, 8; Primary Batteries=4, 8;
Secondary Batteries=4, 8; Pilot Plant Operations=4, 8; Production Equipment=4,
8; Development=4, 8; Research=4, 8; Contract Research=4, 8.

REVISED: Jul 82.

COMPANY: BARON COMMUNICATIONS Ltd

CODE: BCL

ADDRESS: P. O. Box 82010
6939 East Hastings St
Burnaby, British Columbia, Canada V5C 5P3

CONTACT: John Munro, Vice President - (604) 291-8272

HISTORY: Baron Communications (formerly Challenger Electronics) was formed in 1960 as a wholly owned Canadian Corporation with representatives in Washington, Oregon, California, Arizona, Texas, Michigan, and Illinois.

CAPABILITY: Baron specializes in the manufacture, design, and development of various types of tone signalling, alarm & status, and control systems, radio, and telephone interconnect terminals & associated mobile control heads.

AVERAGE WORK FORCE: 14

GROSS SALES: 1979 - \$0.58M
1980 - \$0.50M
1981 - \$0.40M
1982 - \$0.50M (Forecast)

PLANT SIZE: 7,000 sq ft

EQUIPMENT: Baron's equipment consists of Exorcisor II - Computer Development System 96K RAM, 1M Disc Capacity Development Module for 6800-6802 & 6801 Processors, PROM Programmer, and EPROM Programmer with Exorterm 150 console & Model 703 printer. They also have the usual assortments of oscilloscopes, VTVMs, spectrum analysers, temperature environment chambers, transmission test sets, etc., necessary for the design and development of advanced circuitry.

EXPERIENCE: Baron is a recognized and accredited supplier of tone signalling equipment and systems (DTMF, in band, singleton, two tone simultaneous or sequential) to - Motorola, GE, Pacific Northwest Bell Telephone Co, Michigan Bell Telephone Co, General Telephone & Equipment, Getty Oil Company, ALASCOM, AT & T, US Army Corp of Engineers, and the RCMP. They are also in the final stages of development of a signalling system (designed for CRC Ottawa) which will provide selective calling on HF/SSB.

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics; Microprocessors=6, 7; Tone Signalling=5, 7; Telephone Systems=5; Microwave Systems=5; Status Systems=5; Alarm Systems=5, 7; Telephone Interconnect Terminals=5; Mobile Control Heads=5; Based Tone Signalling=5, 7.

REVISED: Sep 82.

COMPANY: BARRINGER RESEARCH Ltd

CODE: BRL

ADDRESS: 304 Carlingview Drive
Rexdale, Ontario, Canada M9W 5G2

CONTACT: Mr. John Davies, V P Engineering - (416) 675-3870

HISTORY: Barringer Research was founded in 1961 to develop geophysical/geochemical techniques and instrument systems relating to mineral exploration. Barringer Resources Inc (formerly Barringer Research Inc) was incorporated under the laws of the state of Delaware on 7 Sep 67 for the purpose of acquiring all of the issued and outstanding voting stock of Barringer Research Ltd, an Ontario (Canada) corporation.

CAPABILITY: Barringer has undertaken research projects primarily in the earth sciences in the disciplines of geology, geochemistry, electro-optics, electromagnetics, magnetics and atmospheric physics. As a result of such projects, they have developed instrument systems and techniques in the fields of airborne and ground mineral exploration and environmental and process monitoring. They have recently devoted a substantial portion of their efforts toward adapting for oil and gas exploration, the instrument systems, and technology that they initially developed for mineral exploration, as well as toward developing new oil and gas exploration instrument systems and technology.

Barringer's research and development activities have led to the following systems:

The INPUT® (INDuced Pulse Transient) - This system was the original development of Barringer and is the only commercial airborne electromagnetic prospecting system to use a pulsed field principle. The system has been successful in its application in the search for mineral deposits. The success of the system was recently recognized by the Society of Exploration Geophysicists which awarded Dr Anthony R Barringer the Kauffman Gold Medal of the Society for his contributions to the science and practice of geophysics via the INPUT system. According to the Society's statistical returns, 70% of all the world's commercial airborne electromagnetic surveys are carried out with the INPUT system.

COTRAN® (CORrelation of TRANsients) - This system uses a new approach to signal processing that can only be achieved by digital techniques. The airborne computer analysis of the data is believed to give the system substantial advantages in terms of sensitivity and interpretability. Only one COTRAN system exists at the present time, and is currently undergoing evaluation in surveys that are part testing and part operational.

TIVAC - This system is aimed at detection of hydrocarbon leakage over oil deposits by geophysical remote sensing methods.

Metal detection systems have also been developed by Barringer as a spin-off from its airborne geophysical equipment. A modification of the original design was used for traffic counting and tramp metal detection on conveyor belts. Subsequently, this patent has been used as a metal

detector in walk-through systems installed in airports. It has also been used on conveyor belts to protect ore crushers from damage caused by ingesting pieces of metal that accidentally get mixed in with the ore. A new prototype system has functioned well and has demonstrated a significant advantage in that it can be programmed to ignore pieces of metal, such as the clips of conveyor belt seams, which give a signal that will usually trigger a false alarm. It is anticipated that there will be further development of the COTRAN principle, possibly using new microcomputer technology, allowing production costs to be reduced so that the system can be supplied to a number of new applications. This system may also be used for military range clearance.

A new product known as a Raticing Radiometer is an optical device for measuring the reflectance ratios of pairs of wavelengths in the visible and infrared region. The instrument has application in identifying clay minerals for mapping purposes when exploring for mineralization and in the follow-up of targets of interest selected from satellite imagery and aerial photography, particularly with regard to the forthcoming US Landsat-D satellite and the French SPOT (Système Probatoire pour Observation Terrestre) satellite. Both of these satellites use infrared channels that generate new kinds of information that can be checked on the surface with the Radiometer. The first production run is in progress.

Barringer has for many years been involved in the manufacturing of certain exploration instrumentation and monitoring equipment. An increase in their product line is planned. Towards this end, 13,000 sq ft of space have been added to their Toronto facility.

Another product of the company is its range of on-stream heavy water monitors for monitoring the heavy water content of flow streams in nuclear reactors. Barringer is a supplier for the CANDU, Canadian heavy water reactor, which has seen expanded use in Canada and other countries.

COSPEC® (Correlation SPECTrometers) - These are the only commercial available remote sensing devices for the monitoring of atmospheric concentrations of sulphur dioxide and nitrogen dioxide. They perform a unique function in the monitoring of air pollution. The joint use of the networks of ground sensors and remote sensing equipment is used as a tool for modeling air pollution episodes and various research investigations of air pollution problems.

Additional specialized optical systems for monitoring gases are manufactured by the company, including the GASPEC® infrared system for remote detection of gases, and its Correlation Interferometer that is used in related areas. These instruments are generally manufactured on special order for governmental agencies such as NASA.

SURTRACE® - This system is a helicopter-mounted airborne geochemical technique which uses a long flexible probe mounted beneath the helicopter to vacuum surface microlayer samples of material off the ground. Special tape sampling equipment is carried in the helicopter to store the samples sequentially, and a technique known as LASERTRACE® has been developed for providing 25 element analyses of the minute traces of material collected

from the ground surface. The analytical technique is fully automated and computerized and is capable of high volume production. The system has already been used successfully in operational programs. Experience to date with the equipment has been restricted to mineral type surveys, however, potential applications in the hydrocarbon field have been established by the use of related ground equipment over oil fields. A ground version back-pack model has also been successfully used.

AIRTRACE® - This is a system that extracts and analyzes aerosol in the atmosphere and is a forerunner of the SURTRACE system. Although the AIRTRACE equipment is operational, its usage is limited to specific meteorological conditions. This limitation results in high costs of surveys and hence is a restriction on more general use of the AIRTRACE method.

AIRBORNE LASER FLUOROSENSOR - This is a successful airborne laser that has been constructed for a Canadian government organization and has functioned very effectively in tests and surveys designed to detect and classify oil slicks.

GASPEC - A remote sensing gas filter cell spectrometer which NASA Langley Research Center has used in flight tests and which has proven satisfactory in monitoring atmospheric carbon monoxide. This equipment was incorporated as one of the five experiments carried on board the first Space Shuttle. The experiment is based on Barringer's design, and the space flight hardware was constructed by TRW Systems Group. The aim of the test is to monitor the global distribution of carbon monoxide.

The GASPEC concept is also to be used in the ERBS (Earth Radiation Budget Satellite) wherein it will detect HF, HCl, CH₄, and NO by looking at the rising and setting sun from the satellite (the HALOE or HALogen Occultation Experiment).

AVERAGE WORK FORCE: Engineers & Scientists - 34
Technical Support - 30

Barringer Research retains on staff a diverse group of Scientists and Engineers in the physical sciences. Barringer Magenta retains expertise in analytical chemistry, geochemistry and microbiology. The professional and supporting technical staffs shown above are for the metropolitan Toronto location only. The total US and Canadian professional strength is 52 Scientists and 13 Engineers.

GROSS SALES: 1978 - \$3.9M
1979 - \$5.0M
1980 - \$5.9M

PLANT SIZE: Barringer Resources Inc, Barringer Research Ltd, and Barringer Magenta Ltd lease the following office and laboratory space:

<u>Location</u>	<u>Sq Ft</u>	<u>Purpose</u>
1626 Cole Blvd Golden, Colorado	15,200	Office & Laboratory

304 Carlingview Dr Rexdale, Ontario	28,000	Office, Laboratory & Mfg
1455 Deming Way Sparks, Nevada	7,200	Laboratory
5161 Ward Road Wheat Ridge, Colorado	3,000	Laboratory
3750 19th St, N. E. Calgary, Alberta	2,900	Laboratory
1156 First Ave Whitehorse, Yukon	1,500	Laboratory

EXPERIENCE: Barringer experience is world-wide. Recent R&D clients include - Petro-Canada Explorations Inc; TRW Systems Group (USA); National Research Council of Canada; US Air Force; Department of Supply & Services (Canada); Rexnord Inc (USA); Atomic Energy of Canada Ltd; NASA Langley Research Center (USA); and Atmospheric Environment Services (Canada). Previous contracts for the USAF include one for Wright-Patterson AFB, OH - "Remote Detection of Chemical Vapors using Correlation Interferometric Techniques" in 1969; and one contract for Brooks AFB, TX - "Development of a Hydrazine/Carbon Monoxide GASPEC" in 1976-1979.

KEYWORDS: 7=Electronics; 9=Environment; 10=Image Processing & Optics; 11=Lasers; 17=Software Services; Infrared Instrumentation=7; Airborne Surveys=9; Environmental Analysis=9; Remote Sensing=9; Trace Gas Detection=9; Spectroscopy=11; Geographic/Geologic Analysis=17; Electro-Optics=10; Signal Processing=7; Data Analysis=7; Metal Detection=7; Instrument Manufacture=7; Remote Gas Detection=9; Airborne Laser Fluorosensor=11; Hazardous Gas Detection=9.

REVISED: Nov 82.

COMPANY: BELL AEROSPACE CANADA TEXTRON
(Division of Textron Canada Ltd)

CODE: 241

ADDRESS: P. O. Box 160
Grand Bend, Ontario, Canada NOM 1T0

CONTACT: J B Timbrell, Managing Director - (519) 238-2333

HISTORY: Bell Aerospace was registered to do business in Canada in 1966. The parent company is Bell Aerospace Textron located in Buffalo, New York.

CAPABILITY: Bell Aerospace concentrates in the areas of design, development, manufacturing, and production. They specialize in air cushion vehicles and systems.

AVERAGE WORK FORCE: Engineering - 6
G & A - 9
Others - 80

GROSS SALES: 1982 - \$15M

PLANT SIZE: 38,000 sq ft

EQUIPMENT: Data processing on all operations.

EXPERIENCE: US Army (LACV-30 Program); DeHavilland Aircraft (special components and tooling for Dash-8 Program); LACTA Program; Bell/Canadian Federal Government Joint Development Program (Light air cushion triphibious aircraft); and Canadian/USAF Joint Defense Program (Air Cushion Equipment Transporter - ACET - Program).

KEYWORDS: 1=Aircraft; Air Cushion Vehicles=1; Air Cushion Systems=1;
Air Cushion Equipment Transporters=1.

REVISED: Sep 82.

COMPANY: BELL-NORTHERN RESEARCH

CODE: BNR

ADDRESS: P. O. Box 3511, Station C
Ottawa, Ontario, Canada K1Y 4H7

CONTACT: Mr. David J Wiegand, Marketing Liaison Mgr - (613) 596-4493

HISTORY: Bell-Northern Research has been a Canadian corporation since 1971 owned jointly by Northern Telecom Ltd and Bell Canada (70/30). The company was founded in 1957 as the R&D arm of Northern Electric (original name of Northern Telecom). Bell-Northern Research Inc is a wholly owned subsidiary located in Palo Alto, CA. BNR's headquarters and three main laboratories are located in Ottawa, with other laboratories in Montreal, Edmonton, and Toronto. Most of BNR's research and development is carried out for its owners; however, some is done for Government agencies, other telephone companies, and industries in related fields. There is no relationship between BNR nor its parent companies, and the Bell System of companies in the US.

CAPABILITY: BNR is experienced in all aspects of telecommunications research with established technology in large scale integrated (LSI) circuits, fiber optic transmission systems, transmission lines, and software. New technologies will include VLSI circuits, charge couple device imaging, and robotics (small volume manufacturing application). Their laboratory R&D is carried out in four operational divisions - Systems, Transmission & Data, Digital Switching Systems Development, and Technology. The prime thrusts of the Systems Division are the design of intelligent networks for future office and residential services; the definition of new fiber optic trunk and distribution systems; speech and image processing research; and planning studies to improve data networks and toll, local and subscriber loop operations. The Transmission and Data Division staff works on system development in areas such as analog and digital radio transmission, outside plant, business communications and data, and fiber optics. The division contains a group which provides all of BNR with computer and engineering design services, plus two other groups that provide support in the standardization of designs and materials, and the documentation of both hardware and software. The Digital Switching Systems Development Division is engaged in all aspects of computer technology. The Technology Division is charged with exploiting new technological opportunities for Northern Telecom and supporting current technologies and products. The division is comprised of the Silicon Technology, Product Integrity, Manufacturing Engineering, and Subscribers Equipment and Terminal Groups. BNR also maintains a large industrial library holding more than 26,000 publications and about 450 periodicals in 40 languages.

AVERAGE WORK FORCE: PhDs - 210
BSs, MSs - 1174
Others - 1900

GROSS SALES: 1981 - \$195M (Approx)
1982 - \$240M (Approx)
1985 - \$350M (Est)

PLANT SIZE: 79,733 sq meters (3 sites in Ottawa, Canada)

EQUIPMENT: The company has a new IBM 3033 time-sharing general purpose computer, plus a number of mid-range and minicomputers. Their total equipment investment is in excess of \$45M. Included in their equipment is an electron probe microanalyser, scanning Auger spectrometer, and scanning electron microscope. Their many facilities include (1) custom integrated circuit design facility and prototype fabrication line, (2) computer graphics mask pattern design capability, (3) automated testing system for integrated circuits, (4) thick film hybrid pilot line, (5) modern physical analysis laboratory, (6) audio frequency anechoic chamber, (7) opto-electronic materials and device laboratory, (9) optical fiber and cable research facility, (10) advanced systems research laboratory, (11) DMS and SP-1 captive offices and (12) electromagnetic anechoic shielded enclosure.

EXPERIENCE: BNR carries out some R&D for groups other than their owners. They estimate their business with the US military at 0.25%, split evenly between the Army and USAF. They are interested in continuing and expanding their business with the USAF.

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics;
10=Image Processing & Optics; 17=Software Services; 20=Miscellaneous;
Telecommunications=5; LSIC=5, 7; Fiber Optic Transmission Systems=5, 10;
Transmission Lines=5; Communications Software=5, 17; VLSIC=7;
CCD Imaging Devices=10; Robotics=20; Office of Future Equipment=6, 20;
Distribution Systems=5, 10; Trunk Systems=5, 10; Speech Processing=5, 10;
Image Processing=5, 10; Radio Transmission=5; Analog=5; Digital=5;
Fiber Optics=5, 10; Computer Design=6; Computer Technology=5; Cables=10;
Fiber Optic Components=5, 10.

REVISED: May 82.

COMPANY: F. G. BERCHA AND ASSOCIATES Ltd

CODE: FGB

ADDRESS: 640-11th Ave, S W
Calgary, Alberta, Canada T2R 0E2

CONTACT: Dr Frank G Bercha, President - (403) 262-7764

HISTORY: The company was incorporated in 1975 and is Canadian owned. There are branch offices in Cochrane, Alberta, and Ottawa, Ontario, and an affiliate corporation, F. G. Bercha and Associates Inc., located in Texas and Arizona. The US offices are wholly owned by Canadian principals.

CAPABILITY: The company specializes in research and development, and engineering and environmental consulting, with particular expertise in the areas of ice mechanics, remote sensing, Arctic engineering, special structures development, system simulation and risk analysis. The company provides a totally integrated capability due to its multidisciplinary workforce consisting of engineers, environmental scientists and systems professionals.

AVERAGE WORK FORCE: Professionals - 15
Support Staff - 5

GROSS SALES: 1980 - \$1.0M
1981 - \$2.0M
1982 - \$3.0M (Projected)

PLANT SIZE: 8,000 sq ft (Head Office)

EQUIPMENT: Computer terminals and specialized graphic terminals.

EXPERIENCE: The company is perhaps best known for its capability to generate strategic information in relation to Arctic operations. From remote sensing data, the company is able to generate environmental information on ice and ocean systems applicable to the engineering design of structures. On the basis of this information, company engineers are able to turn the information into specific structural design parameters, and carry out preliminary, as well as detailed engineering designs of structures for service in the Arctic frontier regions. In the area of arctic and ice engineering and consulting, the company has been employed by most of the major US companies, including Exxon, Amoco, ARCO, Sohio, Phillips, Mobile, and Chevron. In addition, principal Canadian clients in the Arctic include Dome, Petro-Canada, and Gulf Resources. Finally, the company is well known for its ability to develop novel structures for service in frontier conditions. Such structures have included portable aircraft shelters made of aerospace materials to military specifications. To date, such aircraft shelters have been developed for the Canadian Department of National Defense for military service in support of Arctic airborne operations.

KEYWORDS: 1=Aircraft; 9=Environment; 17=Software Services; 20=Miscellaneous;
Consulting=9; Ice Mechanics=9, 20; Remote Sensing=9; Arctic Engineering=20;
Special Structures=1, 20; System Simulation=9, 20; Risk Analysis=9, 20;
Portable Shelters=1, 20; Mapping=9; Geographic Analysis=17;
Geologic Analysis=17.

REVISED: May 82.

COMPANY: BOEING OF CANADA Ltd
Winnipeg Division

CODE: BOE

ADDRESS: 99 Murray Park Road
Winnipeg, Manitoba, Canada R3J 3M6

CONTACT: Mr. L L Bryson, Vice President - (204) 888-2300

HISTORY: The Boeing Winnipeg plant was established in 1971 and is a wholly owned subsidiary of The Boeing Company of Seattle. There are no other Canadian locations.

CAPABILITY: Boeing is a Canadian leader in high strength/weight ratio fiber composite plastic components for aircraft, space, and other advanced technology applications. The company has the engineering, manufacturing and development expertise to design and build solid laminate or sandwich panel components. Glass, high-modulus graphite and organic fibers, and thermosetting resin systems, including epoxies, polyesters, phenolics or polyimides, are used with state-of-the-art capability. They currently produce both structural and nonstructural glass fiber, and advanced fiber composite components for a diversified range of products covering a technological spectrum from aircraft and satellite components, to thermoformed acrylic bathtubs, light rail vehicles, and farm machinery components.

A stated objective of the company's management team is to establish Boeing of Canada as a center of excellence for composites manufactured within the Boeing Company, and as the Canadian leader in the composite industry. To achieve this objective, they have structured an intensive research and development program and increased tool design and fabrication capability. Significant involvement in the manufacture of advanced composite components for the new Boeing 757/767 aircraft is anticipated.

The Winnipeg Division's Quality Assurance Program operates to one standard of quality which is in conformance with the requirements of the Ministry of Transport Engineering and Inspection Manual (FAR Part 21, Subpart G), the Department of National Defense Specification DND 1015, and with the Boeing Company Corporate Policy 5H1. Quality is maintained throughout the manufacturing process by inspectors appointed by the Manager of Quality Assurance who in turn is approved by the Ministry of Transport. Complete laboratory tests are carried out on process test panels as required by customers and/or pertinent authorities. All raw materials are purchased from qualified suppliers and incoming shipments are subject to Quality Control receiving inspection to ensure that all requirements are met.

<u>AVERAGE WORK FORCE:</u>	Engineering	- 21
	Quality Assurance	- 41
	Production	- 550
	Admin	- 71

GROSS SALES: 1979 - \$18M
1980 - \$23M
1981 - \$25M

PLANT SIZE: 128,000 sq ft (Manufacturing Space)

EQUIPMENT: Boeing's major equipment includes:

- . An autoclave 15 ft in dia, 30 ft long, capable of 95 psi pressure and 625°F ambient temperature.
- . An autoclave 10 ft in dia, 30 ft long, capable of 95 psi and 625°F ambient temperature.
- . An autoclave 4 ft in dia, 10 ft long, capable of 95 psi pressure and 625°F ambient temperature.
- . Air-heated oven with two compartments 8 ft wide, 13 ft long and 8 ft high, with a maximum ambient temperature of 800°F.
- . An air-heated oven with compartments 7 ft wide, 9 ft long, 7 ft high, with maximum ambient temperature of 800°F.
- . 44 inch vertical core cutting bandsaw.
- . Traverse saw capable of cutting up to 16 ft wide material with variable cutting speed.
- . Core milling machine capable of handling core sheets 10 ft long, 6 ft wide and up to 6 inches thick, and capable of milling from 0 to 15 degrees \pm a tenth of a degree.
- . Special taper core milling machine capable of handling sheets 6 ft long, 1.5 ft wide and 2 inches thick, and capable of milling from 0 to 15 degrees.
- . Hydraulic core forming press with 4 ft x 4 ft platen.
- . One 8 ft x 22 ft and one 8 ft x 15 ft waterfall spray painting booth.
- . An 8 ft x 20 ft flame spray booth and apparatus capable of hard and soft ferrous and non-ferrous metal spraying.
- . Assorted saws, routers' drills, punches, shears, finishing equipment, etc, equipped with tungsten carbide and diamond cutters.
- . Automated through transmission, water jet scanning ultrasonic system with C-scan data acquisition.
- . Assorted ultrasonic bond, thickness and flaw detection equipment.
- . A McLean Anderson, Explorer Model D, Filament Winding Machine, capable of producing a part approximately 150 inches long and nine (9) inches in diameter.

EXPERIENCE: Boeing-Winnipeg assumed production responsibility for the majority of all Boeing commercial aircraft. Significant contracts for graphite composites for Satcom and Anik D satellite programs were secured. A technology transfer program, including establishment of a tool design group and upgrading of tooling and part fabrication capability, was initiated in

preparation for increased graphite and hybrid work on the new Boeing 757/767 aircraft programs.

Some of Boeing-Winnipeg customers include:

- . Canadair (Challenger) - fairing flap hinge, assembly wing tips, leading edge flap, access panels, smoke sensor, side console, cover assembly, inboard fairing, latch housing, aft wing-to-body fairing, and horizontal stabilizer tips.
- . DeHavilland - panels, fairings, DHC 7 kevlar trough, and nose avionics bay.
- . Hughes - satellite components.
- . SPAR Aerospace - graphite epoxy plates, and waveguides & satellite components.
- . Boeing Vertol - rain gutters, and CH47 inlet screens.
- . Boeing - 707, 727, 737, and 747.
- . Geonics - magnetometer booms.
- . Geophysics - magnetometer booms.
- . Aerodat - magnetometer booms.

KEYWORDS: 1=Aircraft; 18=Space Systems; 20=Miscellaneous;
Airframe Components=1; Airframe Structures=1; Composite Components=1, 18, 20;
Fiberglass Components=1, 18, 20; Laminates=1, 18, 20;
Graphite Epoxy Components=1, 18, 20; Sandwich Components=1, 18, 20.

REVISED: Oct 82.

COMPANY: BRISTOL AEROSPACE Ltd

CODE: BAL

ADDRESS: 660 Berry St
P. O. Box 874
Winnipeg, Manitoba, Canada R3C 2S4

Rockwood Propellant Plant
Stony Mountain, Manitoba, Canada
(20 miles from main plant)

CONTACT: Mr. Keith Burrows, Marketing VP - (204) 775-8331

HISTORY: Bristol was founded in 1930 and incorporated in Canada in early 1947. It is a wholly owned subsidiary of Rolls Royce Holdings, North American Ltd. Bristol owns and operates the Rockwood Propellant Plant (not a separate division) at Stony Mountain, Manitoba. There are no other subsidiaries operated by the company.

CAPABILITY: Since inception in 1930, Bristol has moved from manufacturing and repairing seaplane floats (1930-1943) to a company with five distinct product areas:

- The manufacture of "hot end" gas turbine components under contract to GE, Pratt & Whitney, and Rolls Royce; and the remanufacture of afterburner assemblies.
- The manufacture of light alloy aircraft structures for three major aircraft - the DHC-7, the L-1011 and the P3/CP-140. Small aircraft structures including a proprietary Wire Strike Protection System are also manufactured.
- The repair and overhaul of military and commercial fixed wing aircraft and military helicopters.
- The manufacture of CANDU nuclear reactor in-core components.

Engineered products manufactured by Bristol include - rocket engine and propellants; vertical axis wind turbines; electronic data instrumentation for payloads and satellites; electronic data instrumentation for remote site applications; and remote automatic inspection systems for steam generators. Services are also provided in mechanical, electrical, aeronautical, and propulsion design and development engineering. Other services include - precision weldments of high temperature stainless steel alloys, titanium and corrosion resistant materials; and a helicopter component test cell for transmission and gear boxes.

Bristol's proprietary products include - Black Brant (sounding rocket); CRV7 (air to surface rocket); WSPS (wire strike protection system for helicopters); LICUS (vertical axis wind powered turbine); CANSCAN (remote, automatic inspection system for nuclear and conventional steam generators); DCP (electronic data collection for remote site application); and READAC (automatic weather station designed for unattended use in airport application).

AVERAGE WORK FORCE: Salaried - 420

AVERAGE WORK FORCE: Hourly - 890
Technical - 100

GROSS SALES: N/A

PLANT SIZE: Production - 451,000 sq ft
Warehouse - 6,000 sq ft
Office - 57,000 sq ft

EQUIPMENT: Complete facilities and equipment for metal forming, welding, machining and metal treating. Numerical Control Machining Center with equipment such as the Sundstrand S-80, S-60, and OM-2A, a Raycon NC EDM, Mazak V5 machine center, and 4 Giddings & Lewis 48" NC VTL. Also included is a PDP 11/70 computer with MDSI. "Action Central" McAuto CAD/CAM System with six design stations. Special facilities include a helicopter transmission test cell, non-destructive test laboratory, and an electronic test laboratory.

Rockwood Propellant Plant - produces HTPB solid propellant for sounding rockets, JATO's drone booster motors, and small military rockets. Present through put is 1,000,000 pounds of propellant annually.

EXPERIENCE: In 1981, approximately 30 percent of Bristol's sales were to the US, with over 85 percent of these sales to the US military. US business includes the manufacture of combustion and exhaust components for the J85, J79, T64, T58 and TF39 engines, and the remanufacture of the TF30 afterburner and general component repair and overhaul.

Other customers in the US include - the Navy, NASA, Pratt & Whitney Aircraft Corp, Lockheed Aircraft Corp, Grumman Aircraft, and Fairchild Hiller Corp.

Canadian customers include - DND, DSS, CCC, National Research Council, Pratt & Whitney of Canada Ltd, Atomic Energy of Canada, Boeing Canada Ltd, Canadair Ltd, DeHavilland Aircraft of Canada Ltd, and others. International clients include - Dornier GmbH, Germany, Royal Netherlands Air Force and the Swedish Space Corporation.

Bristol has been approved by the Canadian Ministry of Transport for Canadian Aircraft maintenance, and the Canadian Forces for manufacturing testing and overhaul. The quality requirements of MOT and FAA and the Canadian DND 1015 or MIL-Q-9858A are met for manufacturing, repair and overhaul.

KEYWORDS: 1=Aircraft; 2=Armament; 7=Electronics; 8=Energy;
9=Environment; 12=Machining; 14=Protective Equipment;
19=Testing/Test Equipment; Airframe Components=1; Airframe Structures=1;
Engine Components=1; Engine Systems=1; Helicopters/Subsystems=1, 19;
Hydraulics=1; Repair & Overhaul=1; Nuclear Reactor Components=8;
Wind Turbines=8; Meteorological Stations/Equipment=9;
Remote Inspection Systems=8; Metalworking=12; Heat Treating=12; Coating=12;
Stamping=12; Spin Forming=12; Titanium=12; Tooling=12; Die Fabrication=12;
Rockets=2, 9; Rocket Propellant=2, 9; Rocket Engines=2, 9;
Helicopter Wire Strike=14; Non-Destructive Testing=1, 19; Instrumentation=7,
19; Transmissions=1, 19; Gear Boxes=1, 19; Data Collection=7; Laboratory=7,
19; Gas Turbine Components=1.

REVISED: Jun 82.

COMPANY: CAD/CAM GRAPHIC SYSTEMS Ltd

CODE: CGS

ADDRESS: 700 Industrial Avenue
Ottawa, Ontario, Canada K1G 0Y9

CONTACT: Mr. Chris Coates, Marketing Rep - (613) 526-0620

HISTORY: CAD/CAM Graphic Systems Ltd is a small Canadian owned high technology company incorporated in May 1979. There is a branch in Toronto and the company is incorporated in the US as CAD/CAM Graphic Systems Inc.

CAPABILITY: CAD/CAM is an engineering design group specializing in computer aided graphics design and artwork generation for printed circuit boards and/or hybrid microcircuits. They also offer consulting services to assist clients in the development of design standards/criteria to suit their special needs. Their product services include: (1) Design from schematic to color-coded layout, (2) Digitizing of color-coded layouts for single, double or multilayered boards (prepared by either the customer or CAD/CAM), (3) Photoplotting of the following artwork masters - component and solderside, drill graphics, solder resist mask, silk screen and assembly, (4) Numerical control drill tapes to suit either Excellon or Digital Systems format, (5) Documentation packages and, (6) Prototype and production quantities of printed circuit boards.

The equipment presently in use at CAD/CAM is a CALMA GDS I Interactive Graphics System that consists of: (1) Data General Eclipse CPU, (2) Four 48x60 inch digitizing tables with dual 19x11 inch CRTs, (3) Color design/edit station with tablet and CRT, (4) CALCOMP 970 pen plotter (on-line) and, (5) GERBER 4432 Photoplotter (off-line).

AVERAGE WORK FORCE: Total - 30

GROSS SALES: 1979 - \$0.16M
1980 - \$0.50M
1981 - \$2.20M (Est)

PLANT SIZE: 8,000 sq ft

EXPERIENCE: CAD/CAM has contract experience with various departments of the Canadian Government, including the Departments of National Defense and Transportation. Canadian industrial experience includes such companies as Northern Telecom, Bell Northern Research, Litton Systems, and AES Data Ltd. US industrial experience includes ITT Aerospace and IBM.

KEYWORDS: 7=Electronics; 17=Software Services; Circuit Layout=17;
PC Board Design=7; Thick Film Hybrid Parts=7; Thick Film Hybrid Design=7;
Thin Film Hybrid Parts=7; Thin Film Hybrid Design=7.

REVISED: Jun 82.

COMPANY: CAE INDUSTRIES Ltd

CODE: CAE

ADDRESS: Corporate Offices
Suite #3060
P. O. Box 30
Royal Bank plaza
Toronto, Ontario, Canada M5J 2J1

CAE ELECTRONICS Ltd
8585 Cote de Liesse
P. O. Box 1800
Saint Laurent, Quebec, Canada H4L 4X4

CONTACT: Dr Murdoch McKinnon, R&D Manager - (514) 341-6780

HISTORY: The company was incorporated in 1947 as Canadian Aviation Electronics Ltd to engage principally in the repair and overhaul of electronics and electro-mechanical equipment and devices. The name was changed to CAE Industries Ltd in 1963 to more accurately reflect its expanding interests in many diverse fields of industry. Diversification and acquisition began in 1961 with the formation of CAE Electronics GmbH in West Germany. Other subsidiaries include CAE Electronics Ltd, Northwest Industries Ltd, CAE Fiberglass Products Division, CAE Aircraft Ltd, Canadian Bronze Company Ltd, Welmet Industries Ltd, CAE Machinery Ltd, Webster Mfg (London) Ltd, Accurcast Die Casting Ltd, CAE-Montupet Diecast Ltd, CAE Morse Division, CAE Lubricators Division, Cleveland-CAE Metal Abrasive Ltd, USP Industries Inc, and CAE Magnesium Products Division. All are Canadian-based except the one subsidiary located in West Germany. This profile will concentrate on CAE Electronics Ltd.

CAPABILITY: CAE Electronics Ltd designs and manufactures sophisticated commercial and military aircraft flight simulators and airborne magnetic anomaly detection equipment. They have also become a major producer of computer-based data acquisition and control systems in the areas of electrical power generation and transmission, oil production, gas transmission, air traffic control, and space.

In the simulator area, they are a leading designer and producer of flight simulators. Their simulators include state-of-the-art technology such as hydrostatic six-degree-of-freedom motion, general purpose computers, and CRF-based instructor's facilities. They reproduce aircraft performance in all flight regimes and, in particular, the critical landing phase. Digital flight simulators have been developed for the A-300, A-310, B727, B737, B747, B757, B767, DC-8, DC-9, DC9-80, DC-10, L1011, F-28, CL-600, and the new generation A-310, B757 and B767. A wide range of simulators has also been supplied to different countries for various types of military aircraft, including tactical jet fighters, jet trainers, antisubmarine patrol aircraft, and transports.

They selectively pursue the US military flight simulator market. CAE also designs and produces simulators for helicopters such as the Agusta AB-205 and AB-212, Bell UH-1D, Boeing-Vertol CH-47, Sikorsky CH-53, and Westland Sea King MK41. In addition to flight simulators, CAE Electronics produces training simulators for nuclear power plants. They are used to train operators to

develop experience in responding to all normal, abnormal and emergency conditions as well as to learn required operating procedures and techniques. In the avionics area, CAE Electronics develops and manufactures magnetic anomaly detection (MAD) systems used in antisubmarine warfare. Their cesium magnetometer system, usually mounted in a stinger at the rear of the aircraft, can measure changes in the earth's magnetic field as small as one part in 5 million.

They have developed a "JETS" joint enroute/terminal data processing and display system for air traffic control. The system is modular and the displayed information tailorable to user requirements. They are active in the space area as they are part of a Canadian consortium, responsible for developing and manufacturing the complete Manipulator Arm system for the NASA Space Shuttle. They have designed and are manufacturing the display and control panel, plus the rotational and translation hand controls that operate the manipulator itself. They have also designed and developed the simulation subsystem which is used as a design tool to test hardware and software modules of the system.

AVERAGE WORK FORCE: Total (CAE Electronics) - 1,700
Technical Staff - 650

GROSS SALES: CAE Industries - \$300M
CAE Electronics - \$ 90M

PLANT SIZE: 300,000 sq ft

EXPERIENCE: CAE Electronics customers include United Airlines, Air Canada, British Airways, KLM, Swissair, TWA, the Canadian Forces, NASA, US Navy, and other departments of the Canadian Government. Current R&D activities include working with the USAF (AFHRL) on a joint program - Design Study for a Wide Field, Helmet Mounted, Infinity Display System Slaved to the Eye, a recently completed study of the LAMARS Air-to-Surface visual system for the USAF, a study for the CAF for a Turret Interactive Crew Simulator, development of computer-based training (CBT) and computer-aided learning technique (CAL), study for an integrated MAD system for inboard use on fixed wing aircraft and helicopters, and a recently completed NASA study on feasibility of a six-degree-of-freedom hand controller.

KEYWORDS: 1=Aircraft; 3=Avionics; 7=Electronics; 8=Energy;
16=Security & Safety; 17=Software Services; 18=Space Systems;
20=Miscellaneous; Flight Simulators=1, 3; Magnetic Anomaly Detection=3, 16;
Data Acquisition Systems=1, 8, 18, 20; Data Control Systems=1, 8, 18, 20;
Training Simulators=8, 20; Air Traffic Control Systems=20; Control Systems=18,
20; Repair & Overhaul=3, 7; Video Display Systems=7; Simulation Programs=17.

REVISED: Jun 82.

COMPANY: CANADA SYSTEMS GROUP
Advanced Technology Systems Division
(Formerly Digital Methods Ltd)

CODE: CSG

ADDRESS: 1736 Courtwood Crescent
Ottawa, Ontario, Canada K2C 2B5

CONTACT: Mr. R T C Cobbold, Director Marketing - (613) 225-1171

HISTORY: Canada Systems Group is a Canadian owned high technology company originally incorporated as Digital Methods Ltd in 1967. Their technical experience is in the field of computer systems and programming. CSG was established in 1971 to provide computer based information services to industry and government. The large parent company has its head office in Mississauga, Ontario, with branches in nine Canadian and four US cities. Other division locations are in Don Mills, Ontario, and Calgary, Alberta.

CAPABILITY: Canada Systems Group's expertise lies in the areas of - 1) analysis, design, and specification of real time control systems; 2) analysis, design, specification & implementation of information retrieval & data base systems; 3) analysis and organization of associated manual systems; 4) project management; 5) technical support; and 6) training. The activities of the Division are mostly concerned with micro/minicomputers.

AVERAGE WORK FORCE:

PhDs	- 1
Engineers	- 65
Others	- 34

GROSS SALES: 1980 - \$3.5M
1981 - \$4.0M
1982 - \$6.0M (Estimated)

PLANT SIZE: 12,000 sq ft

EQUIPMENT: Machines currently used by Canada Systems Group are Hewlett Packard 2114, 2116, 21MX, Series 3000, Digital Equipment Corp (LSI-11, PDP-10, PDP-11), Data General NOVA and ECLIPSE series, Motorola 6800, and Intel 8080.

EXPERIENCE: Canada Systems Group has extensive experience with a large number of federal and provincial government agencies and with various business and industrial organizations. Private sector contracts include some in the US and UK. Typically, less than 5% of their sales are to the US. Typical projects handled by the Division are studies; simulator systems; systems software design and implementation; computer graphics for air traffic control; satellite ground control systems (software design, and program and implementation); VTOL/STOL data handling system design & implementation; computer aided graphics; and telex switching systems (software development). Other project areas include computer dispatch, supervisory control, data acquisition, and material handling systems. They have worked with Rapistan Inc and QEI Inc. The company has no past contracts with the USAF or other DOD agencies. They are interested in expanding into the US market and doing business with the USAF.

KEYWORDS: 6=Computers; 7=Electronics; 17=Software Services; 20=Miscellaneous;
Computer Dispatch=6, 7; Supervisory Control=6, 7; Data Acquisition=6, 7;
Air Traffic Control Systems=6, 20; Graphics=17; Real Time Graphics=17;
Telex Exchange Computer Systems=6.

REVISED: Sep 82.

COMPANY: CANADA WIRE & CABLE Ltd

CODE: CWC

ADDRESS: Corporate Office
250 Ferrand Drive
Don Mills, Ontario, Canada M3C 3J4

CONTACT: Mr. V S Carpenter, Manager, Commercial Services - (416) 424-5183

HISTORY: Canada Wire & Cable Ltd is a diversified manufacturer operating businesses across Canada and the US, with partners in associated companies overseas. The company is a subsidiary of Noranda Mines Ltd and is involved either directly or through its subsidiaries and associates in the manufacture of electrical, electronic and communication wires and cables, plastic pipe and fittings, optical fiber cables and components, electronic medical instruments, transformers, lighting, and other products.

Canada Wire was incorporated in 1911 and began producing cables for the fledgling electrical industry. By the mid-1920s, it had expanded its product line and located sales offices and warehouses across Canada. In 1929, Canada Wire & Cable Ltd amalgamated with Standard Underground Cable and began producing a wide range of power cables. During subsequent years, the company integrated its operations by building a copper rod mill to supply basic conductor material. They expanded to a full product range in the 1950s when they established specialized product plants in many parts of Canada. Export activity grew and, during the past two decades, led to joint venture businesses in several overseas countries. More recently, Canada Wire has diversified through the development of new products and the acquisition of companies in related industries.

CAPABILITY: Canada Wire is the largest wire and cable company in Canada and is ranked by industry sources as the second largest in North America, not including its overseas associates' operations. It is among the hundred biggest Canadian companies.

. Wire and Cable Group - the largest portion of its wire and cable business is organized on the basis of six divisions, each with distinct products and markets. These divisions are:

- (1) Power & Control Products -
Markets: Electrical Utilities, Construction Industry
Plants: Quebec City, Quebec; Leaside, Ontario
- (2) Communication Products -
Markets: Telecommunication Utilities
Plants: Winnipeg, Manitoba; Weyburn, Saskatchewan; Vancouver, BC
- (3) Construction Products -
Markets: Building Industry
Plants: Fergus, Ontario; Etobicoke, Ontario
- (4) Equipment and Electronic Products -
Markets: Automotive and Industrial
Plants: Orangeville, Ontario

- (5) Copper Rod Products -
Markets: Wire and Cable Manufacturers
Plants: Montreal East, Quebec
- (6) Canstar Communications (Fiber Optics) -
Markets: Telecommunications
Plants: Scarborough, Ontario; Winnipeg, Manitoba

In the area of development, Canada Wire continues to be an aggressive growing company. Several major investment projects currently in progress include:

- . Rebuilding of the Leaside Power and Control Cable plant.
- . Haxelett-Krupp continuous cast copper rod mill in Montreal.
- . Research and production facility for fiber optics in Winnipeg.

These expansion projects, in addition to further acquisitions and international investments, demonstrate Canada Wire's determination to maintain its leadership in technology and business development.

Canada Wire & Cable Ltd subsidiaries include:

- . Carol Cable Company (US) - manufactures large wire and cable in the US. Acquired in 1981, it has eleven manufacturing plants specializing in portable cords, electronic wires and power cable, as well as associated products for the industrial, consumer, electronic, and automotive markets. Founded in 1920, Carol Cable has maintained strong growth through efficient manufacturing, prompt service, timely and innovative marketing, and increased preference for its products by industrial customers and consumers.
- . Canwirco Inc (Canada) - manufactures of magnet wire used in the windings for transformers, and electrical generators and motors. The company maintains a strong technical component and specializes in relatively short runs of products of a special nature or design.
- . Grandview Industries Ltd (Canada) - operates plants and sales offices across the country - manufacturing and selling plastic pipe to the industrial, electrical, plumbing and municipal markets, and plastic compounds mainly to injection molders and plastic firm manufacturers. This subsidiary, jointly owned by its US partner, produces injection molded pipe fittings.
- . Radionics Ltd (Canada) - markets and manufactures high technology electronic instrumentation. The company is Toronto-based.
- . Canada Wire and Cable (International) Ltd - active in joint ventures throughout the world. These partnerships developed from the past 50 years of exports and extensive overseas contacts. Although most began in the wire and cable industry, the associated companies have become diversified producing other products such as metals, transformers, lighting, and plastics. The main associated wire and cable companies include:

- (1) Fadaltec (Colombia)

- (2) Conductores Monterrey (Mexico)
- (3) Alambres Dominicanos (Dominican Republic)
- (4) Nigerchin Electrical (Nigeria)
- (5) Tolley Holdings (New Zealand)
- (6) Irish Cable & Wire (Ireland)
- (7) Transwire (South Africa)
- (8) Iconel (Venezuela)

In its joint ventures, the company provides managerial and technical expertise, as well as equity. It engineers and technical specialists assist the associated companies to install new equipment, increase productivity, and improve product quality.

AVERAGE WORK FORCE: Canada - 3,000
 United States - 3,200
 International - 10,000

GROSS SALES: No Data

PLANT SIZE: No Data

EXPERIENCE: Canada Wire has developed export markets in sixty countries around the world in wire and cable, copper rod, electrical, and other products. Its export operations are organized in regions and directed primarily towards markets in the Middle East, Latin America, Caribbean, and the United States.

Some of the US customers of Canada Wire and Cable are - US Government, Houston Wire, American Cordset Co, American Cable Corp, T.W. Comcorp, Phelps Dodge, and Anixter.

KEYWORDS: 1=Aircraft; 7=Electronics; 10=Image Processing & Optics;
 12=Machining; 20=Miscellaneous; Wiring=1, 7; Tubing=1, 7;
 Fiber Optic Cable=10; Medical Electronics=7; Medical Instrumentation=7;
 Injection Molding=12; Plastic Pipe=7, 20; Plastic Fittings=20;
 Fiber Optic Components=10; Transformers=7; Lighting=7, 20;
 Copper Rod Products=20; Cable=1, 7, 10; Magnet Wire=7; Instrumentation=7.

REVISED: Jul 82.

COMPANY: CANADAIR Ltd

CODE: CDR

ADDRESS: 1800 Laurentian Blvd
St Laurent, Quebec, Canada H4R 1K2

Mailing Address

P. O. Box 6087, Station A
Montreal, Quebec, Canada H3C 3G9

CONTACT: Mr. Frederick R Kearns, President - (514) 744-1511

HISTORY: Canadair was incorporated in late 1944 and is owned by the Canadian Government. Other Canadian locations are the Government Liaison Office in Ottawa and a Challenger Sales Office in Calgary. US offices include Canadair Services Ltd with representatives at Lockheed California Co (Burbank) and Boeing Commercial Airplane Co (Seattle and Pasadena); Challenger Sales Offices in Westport (Conn) Atlanta, Houston, and San Francisco; and other Challenger related offices located throughout the US.

CAPABILITY: Canadair has a high technology R&D capability specializing in aerodynamics, flutter analysis, composite materials, remotely piloted vehicles, fracture analysis, and computational design techniques. Their product line includes:

- Challenger business jet aircraft
- CL-215 multi-purpose amphibious aircraft
- CL-89, CL-227 and CL-289 unmanned airborne surveillance system

They have active subcontract work on the Boeing 747SP, 767; Lockheed CP-140, P-3C, McDonnell Douglas F-18A, F-15, and Grumman EF-111A. They specialize in machining to close tolerances (0.001 inch) with a high degree of repeatability. They have an integrated heat treating and stretch-forming system capable of treating and forming aluminum alloy sheets 40 ft x 8 ft x 0.375 in.

Their CL-89 Airborne Surveillance System (unmanned) was designed for use at the Army Division level. It is fitted with either a photographic or infrared line scanning sensor and is reusable. It is launched from a mobile zero-length launcher and recovered with a two-stage parachute system employing inflatable air bags to absorb landing shocks. This drone is stocked in the arsenals of the Canadian Forces, the UK, West Germany, France, and Italy.

The CL-289 is a longer updated version being developed jointly with Dornier GmbH of West Germany. This new vehicle will carry both a photographic sensor and an infrared line scan (IRLS) sensor and will cover a 150 kilometer range at speeds in excess of 700 kph. A real-time data transmission link is associated with the IRLS System. Onboard computers carry the flight instructions for both the CL-89 and CL-289.

The third model, CL-227, is an hourglass-shaped, remotely piloted vehicle still in the Phase II development stage. It is designed as a highly survivable surveillance and target acquisition system for use at medium range. It has VTOL capability and is launched and recovered from a mobile two-meter diameter platform. It can transmit real-time data.

<u>AVERAGE WORK FORCE:</u>	Eng	-	275
	PhD	-	11
	Machinists	-	510
	Others	-	6063
	Total	-	6959

GROSS SALES: 1980 - \$116.2M
1981 - \$265.7M

PLANT SIZE: - 2,700,000 sq ft (under cover)

EQUIPMENT: Their special equipment includes:

- . Two Cincinnati profilers; numerically-controlled; 5-axis: Each bed 212 ft long, 13 ft 4 in wide. Each bed has 3 gantries with 3 spindles each.
- . One Ingersoll profiler; numerically-controlled; 3 axis: Bed 96 ft long, 17 ft 5 in wide. Single gantry with 3 spindles.
- . Nine Wilson profilers; tracer-controlled; 3 axis: Some 6 spindle, some 4 spindle.
- . Several Kearney and Trecker 3 and 5 axis profilers; numerically-controlled.
- . Two Autoclaves; one 15 ft dia, one 12 ft dia, for metal-to-metal, honeycomb and composite bonding.
- . Heat-treat, stretch forming system.

EXPERIENCE: The Canadair experience over the past two years include subcontracts for vertical stabilizers for the EF-11, components for the Lockheed P-3C and CP-140, rear fuselage sections for Boeing 747SP and 767, components for the McDonnell Douglas F-15 and shipsets of components for the Lockheed C-5A. Current products include Challenger business jet, CL-215 multipurpose amphibians and the surveillance systems.

KEYWORDS: 1=Aircraft; 12=Machining; 17=Software Services; 19=Testing/Test Equipment; Airframe=1; Components=1; Composites=1; Extended Length=12; Forging=12; Heat Treating=12; Metal Working=12; Casting=12; RPV=1; Drones=1; Computational Design=1, 17; Aerodynamics=1; Fracture Analysis=19; Flutter Analysis=19; Coating=12.

REVISED: Mar 82

COMPANY: CANADIAN AIRCRAFT PRODUCTS Ltd

CODE: CAP

ADDRESS: 2611 Viscount Way
Richmond, British Columbia, Canada V6V 1M9

CONTACT: Mr. D C Cameron, President - (604) 278-9821

HISTORY: Canadian Aircraft Products Ltd was founded in 1955 to design and produce aircraft floats. The company is Canadian owned and has no other Canadian locations or US subsidiaries.

CAPABILITY: The company designs, engineers and fabricates aircraft components and other allied and support items for the aerospace industry in both aluminum and composites. They maintain a design and engineering office capable of producing products to stated performance specifications and military specifications. They specialize in the design and manufacture of aircraft structures, tools and jigs, support equipment-ground, ancillary equipment-air, cargo handling equipment, aircraft modifications, and aircraft systems.

Modifications to aircraft include the design and installation of additional fuel systems, seats, engine replacement, and structure changes. They have also conducted analyses relative to aircraft/airport compatibility.

AVERAGE WORK FORCE: Total - 160

GROSS SALES: 1980 - \$8M

PLANT SIZE: 75,000 sq ft

EQUIPMENT: Forming capability (3,000 ton rubber bed press), heat treating capability (3x4x18 ft gas-fired oven with water quench) and supporting services. NC milling machines, a composite facility that includes an oven (8x8x10 ft) and an autoclave (5x15 ft).

EXPERIENCE: Canadian Aircraft Products Ltd has a long background of capability and expertise in repair, overhaul, manufacture and fabrication, as well as design and test of aircraft structures and components. They have designed, manufactured and repaired structures and components of a similar nature such as large aluminum boats, air cushion vehicles, etc. They have produced sheet metal fabricated parts for civil and military application. One such contract was for ammunition boxes for Kaiser Aluminum. They produce wing floats for the Canadair CL-215 water bomber and the floats for the DeHavilland Twin Otter aircraft. The company has built and structurally tested the complete airframe of the Trident Aircraft Ltd Trigull aircraft. Other contracts include the horizontal stabilizer and auxiliary fuel tanks for the Canadair CL-600 aircraft, control surfaces and airstair door for the DeHavilland Dash 7 STOL airliner, the horn assembly for the McDonnell Douglas DC-9, Saberliner detail parts for N. A. Rockwell, and the design, engineering and production of the horizontal stabilizer, elevators and rudders for the DeHavilland Dash 8 commuter aircraft.

KEYWORDS: 1=Aircraft; 12=Machining; Airframe Components=1;
Airframe Structures=1; Cargo Handling Equipment=1; Systems=1;
Helicopter Subsystems=1; Repair & Overhaul=1; Aluminum Components=1;
Composite Components=1; Modification=1; Tooling=12; Jig Fabrication=12.

REVISED: Jun 82.

COMPANY: CANADIAN ASTRONAUTICS Ltd

CODE: CAL

ADDRESS: 1024 Morrison Dr
Ottawa, Ontario, Canada K2H 8K7

CONTACT: Mr. James D Taylor, President - (613) 820-8280

HISTORY: Canadian Astronautics is a rapidly growing, wholly owned Canadian company incorporated in 1974. There are no Canadian divisions and no US subsidiaries. Company interest is in systems engineering, and is concentrated in five principal business areas - satellite, electrical, computer, mechanical, and microwave. Their initial business was in the area of space systems design.

CAPABILITY: As previously mentioned, Canadian Astronautics is divided into five principal business areas. They have conducted numerous studies on satellite systems design for space missions in the areas of communications, remote sensing, search and rescue, position location/navigation, data collection, and science. The studies breakdown included concept and program definitions, trade-off analyses, baseline design, specification preparation, and cost estimations. Their electronic systems design includes RF, and analog & digital technology. Recent projects have included studies of an airborne synthetic aperture radar, an experimental tracking radar test facility, and microwave radar simulation test facility. Canadian Astronautics designs and develops computer systems and microprocessors, both real and non-real time, for scientific and engineering applications. Their success in this area is facilitated by in-house minicomputer and microprocessor systems for simulation work, interface checkout, and software development. Their mechanical design team, using computer aided stress, structural dynamics, and thermal analysis techniques, has applied its design talents in the areas of mechanical fixtures, test rigs, electromechanical design, and environmental testing. They also provide structural design, finite element stress and dynamics analysis, and thermal design & analysis. Areas of particular interest to the USAF may be command and control, signal processing, radar, sonar, data communications, electronic warfare, satellite system studies, and antenna work.

AVERAGE WORK FORCE: Scientists & Engineers - 55
Others - 25

GROSS SALES: 1980 - \$1.6M
1981 - \$8.0M

PLANT SIZE: 21,000 sq ft

EXPERIENCE: Canadian Astronautics has participated in over 200 contracts and has never experienced an over-run. Their contracts have been divided between the Canadian Government (25%), NASA (30%), and others (45%). Canadian Government departments include Communications, National Defense, Environment, Energy Mines & Resources, National Research Council, and the Ministry of Transport. Private sources include Atomic Energy of Canada Ltd, Telesat Canada, European Space Agency, Intelsat, Ontario Hydro, plus others. Canadian Astronautics has no direct contracts with the USAF, but are directly involved through the SARSAT program. One of the four satellite ground stations being

built under the program will be located at Scott AFB, IL. Canadian Astronautics can perform to military specifications.

KEYWORDS: 5=Communications; 6=Computers; 7=Electronic; 15=Radar; 17=Software Services; 18=Space Systems; 19=Testing/Test Equipment; Antennas=7, 15; C3 Systems=5; Computer Parts=6; Navigation=7; Solid State Devices=7; Environmental Testing=19; Simulators=15; Phased Array=15; Synthetic Aperture=15; Design to Requirement=17; Structural Analysis=17; Structural Design=17; Communications=18; Data Reduction=18; Radar=15, 18; Ground Stations=18; Satellite Electronics=18; System Studies=18; Remote Sensing=18; Search & Rescue=18; Design=6; Microprocessors=6, 7; Test Rigs=19; Electromechanical Design=19; Electronic Warfare=7; Signal Processing=7.

REVISED: Sep 82.

COMPANY: CANADIAN GENERAL ELECTRIC COMPANY Ltd

CODE: CGE

ADDRESS: Aerospace Operations
Industrial Benefits Program-Defense Programs
396 Attwell Drive
Rexdale, Ontario, Canada M9W 5C3

CONTACT: Mr. Brian Noble, Spec Industrial Benefits Program - (416) 675-7500
X210

HISTORY: Canadian General Electric Company was incorporated in 1892 and is ninety-two percent owned by General Electric Company.

CAPABILITY: The Cobourg (Ontario) Plant - one of the largest Canadian custom molders, specialize in thermoplastic injection molding, and thermoset injection & compression molding. They manufacture all types of composite molding for military purposes (e.g., rocket nozzles) and work to MIL SPEC 105.

The St Andrews (Quebec) Plant - specializes in fiberglass wound tubes for underground duct and high pressure pipes. They accept custom orders for military projects, such as, launch tubes (pod and hand-held) and rocket motor casings, etc., for the US Army.

The Scarborough (Ontario) Plant - is dedicated to precision machining and fabrication. They specialize in very large items.

AVERAGE WORK FORCE: 20,549 - Total

GROSS SALES: 1980 - \$1.5B

PLANT SIZE: Cobourg Plant - 125,782 sq ft
St Andrews Plant - 50,000 sq ft
Scarborough Plant - 330,000 sq ft

EXPERIENCE: Canadian General Electric works with the Canadian Government, US military and many US and Canadian prime contractors (e.g., General Motors, Xerox, etc.).

KEYWORDS: 1=Aircraft; 2=Armament; 12=Machining; 20=Miscellaneous; Composite Components=1, 2, 20; Injection Molding=2, 12; Launch Tubes=2; Rocket Nozzles=2; Rocket Motor Casings=2.

REVISED: Mar 82.

COMPANY: CANADIAN MARCONI COMPANY

CODE: CMC

ADDRESS: 2442 Trenton Ave
Montreal, Quebec, Canada H3P 1Y9

Electronics Group
Avionics Division
Components Division
Data Communications Division
Communications Group
Commercial Communications Division
Special Services Division
Defense Communications Division

Radar Division
415 Legget Drive
Kanata, Ontario, Canada K2K 2B2

CONTACT: Mr. Jack Howlett, Vice President Admin - (514) 341-7630, X204

HISTORY: Canadian Marconi was incorporated in Montreal in 1903 as the Marconi Wireless Telegraph Company of Canada, primarily for the purpose of operating a transatlantic communications link and a ship-to-shore communications service. The company maintained its interest only in communications until the end of the 1950s. In the 1960s, products diversified to include marine radar and airborne navigation systems.

Canadian Marconi operates sales and service branches in 22 Canadian cities and has a wholly owned subsidiary in the US (CMC Electronics Inc, 1900 North Beauregard St, Suite #103, Alexandria, VA 22311). The General Electric Company Ltd of London, England owns 51.6% of Canadian Marconi's common stock. The remaining 48.4% is owned by small shareholders equally in the US and Canada.

CAPABILITY: Canadian Marconi has expertise in two major fields - Electronics and Communications. The total company capability of potential interest to the USAF can best be shown by describing each of six divisions, all of which are located at the Montreal site, except for the Radar Division which is located at the Kanata site.

AVIONICS DIVISION: The Avionics Division is engaged in the development, engineering, production of aircraft navigation, and other systems:

Doppler Navigation Systems - determine aircraft velocity in forward, side, and vertical axes by transmitting microwave energy to the earth's surface and measuring the Doppler frequency shift in back-scattered radiation picked up by a receiver. By feeding this velocity information combined with heading information, to a navigation computer, the aircraft position is calculated and displayed. Doppler Velocity Sensors, and Doppler Navigation Systems with self-contained navigation computer and interactive CRT display, are available for all types of aircraft over a broad range of performance envelopes.

Omega Navigation Systems - accept coded VLF signals from eight Omega ground stations, and by measuring the phase differences in the signals from three stations, simultaneously produce a hyperbolic grid pattern from which the aircraft's position anywhere on the earth's surface can be determined. Several models of the receiver/computer/antenna components provide a complete range of systems suitable for world-wide navigation in military, general aviation, business, and commercial airline aircraft - both rotary and fixed wing. Options for additional use of VLF communication stations are available, as are several versions of the basic Omega System for different operating modes and user requirements. Extensions of the Omega System to very low cost vehicles, such as drones are under investigation.

Navstar Global Positioning System - receives signals from earth-orbiting satellites that continuously transmit information on their own position, orbital parameters, and time. When completed in 1987, the total constellation will comprise of 18 satellites in several planes mutually inclined at 55 degrees. The airborne system processes the received signals and provides positional accuracy to within 16 meters in each of three planes.

Engine Instruments - use sub-miniature lamps and fiber optics to present the information, and have eliminated all dependence upon mechanical devices. In addition to the main feature of saving space in over-crowded cockpits, these instruments are extremely flexible in that sections of the parameter range can be emphasized at will, and they can be color-coded to alert the pilot to dangerous situations and to provide easy readability, thus improving safety and reducing pilot workload. Digital readouts of parameters for very high resolution and redundancy can also be incorporated. A broad spectrum of applications and a variety of designs are features of this product line.

Intelligent Instruments - combine normal sensor inputs with pre-programmed and manually entered data, process them via micro-processors under software control, and display computed parameters to provide performance and analytical information. Typical examples include the Flight Advisory Computer, which calculates and displays the optimum airspeed and altitude for the present gross weight, the gross weight, and the time and fuel remaining. The Status Display Systems prioritizes and displays up to 110 warnings and cautions, up to 1,000 checklist items, and includes facilities for complete maintenance data logging. It features optional voice warning; automatic fault cancellation, storage, and recall; dual redundant processing and power supplies; and channel failure indication. The Data Collection Unit, which can be used in conjunction with the Status Display System, provides for all scheduled and unscheduled maintenance activities by means of plug-in memory modules. It includes a self-contained, portable microprocessor with an integral thin-film electroluminescent screen, and interchangeable dedicated and general keyboards.

Photogrammetry - includes the computer based Analytical Stereoplotter which enables an operator to determine the position and size in three dimensions of an object or an area from pairs of stereoscopic photographs. The resulting digital information can then be stored in a

computer data bank from which it can be recalled for use in constructing maps and charts, updating existing maps, comparing changes from previous photographs, etc. Many tasks are automated providing an order of magnitude enhancement in capability for the photogrammetric community.

Data Communications - a product line introduced in 1975 that provides central office equipment for Telex/Data networks. The product design emphasizes large numbers of connections and non-blocking operation, with current designs allowing for up to 30,000 switched circuits connected through a fully folded, fully available switch block at speeds of 50 to 9,600 bps, with all current accepted protocols and special customer services and features.

DEFENSE COMMUNICATIONS DIVISION: The Defense Communications Division specializes in only one field - military tactical communications:

Tactical Radio Relay - the AN/GRC-103 Radio Set operates in the 220 to 1850 MHz frequency range in four frequency bands. The radio set will accommodate frequency division multiplex (FDM) or time division multiplex (TDM) equipment. The TDM equipment may be pulse code modulation (PCM) or delta modulation (DM) multiplexers. Associated with the radio set is a test facility, the AN/GRM-95, used as a depot maintenance facility. The test facility is now available to test all four frequency bands of the radio. The AN/GRC-103 in conjunction with multiplexer equipment is configured into standard US Army and Marine Corps systems, e.g., AN/TRC-113, AN/TRC-145.

Multiplexers - the MTD-24 Combiner is used with PCM multiplex equipment to increase the traffic carrying capacity of the AN/GRC-103 from 12 channels to 24 channels. The MTD-212 performs a similar function to the MTD-24 with reduced capabilities. The TD-5064 is a 15 channel delta modulation multiplexer replacing PCM equipment in new TDM systems. The TD-5064 is capable of being stacked so that units will provide a system capability of 63 traffic channels.

Tactical Switchboards - the MSB1224 Switchboard is a microprocessor controlled 12 line semi-automatic cordless field telephone switchboard. A facility exists to enable two MSB1224's to be connected together to provide a 24 line capability. Similarly for larger installations, the SB-3082 is a 50 line switchboard capable of being stacked to provide 100 lines.

Radio Wire Integrator - the C-6709 Radio Wire Integrator provides a capability to enable single channel net radios to be connected to the switched telephonenetwork.

In addition to its existing products, Defense Communications Division is currently developing several new devices:

ECCM Radio - to develop the next generation of tactical radio relay equipment capable of surviving in an electronic warfare environment (a seven year program). Feasibility hardware will be made at the end of the second year followed by full scale development.

DOW-103 - the Digital Order Wire for the AN/GRC-103 Radio will give the system a capability to be NATO interoperable in accordance with the STANAGS now being finalized.

DC/AC Inverter Power Supply - a requirement of the US Marine Corps, this power supply enables the AN/GRC-103 to be driven from a DC supply.

Radio Ancillaries - the Eurocom Adapter will enable the radio to interface to existing European multiplex equipment. A Transmission Quality Monitor (TQM-103) will be used to measure radio system performance.

Conditioned Diphas Adapter - part of the US Marine Corps program, this unit enables multiplexer, crypto and secure order wire units to connect together and to the AN/GRC-103 radio to form a Digital Wideband Transmission System.

Line Terminating Unit - this is an external deltaplex option and enables separation of the radio and multiplex equipment by a distance of up to 2 km. Fiber optic technology will be applied in this product as an interface option.

Deltaplex Internal Options - several deltaplex options are to be developed to enhance the flexibility and marketability of the basic product.

Switchboard Extension - a family of switchboards is to be developed to be used in many identified tactical situations. This includes on-going development of the MSB-1224.

RADAR DIVISION: The Radar Division specializes in the development, engineering, and production of surveillance radar:

Naval Surveillance Radar - the AN/SPS 503 is a light-weight S-band surveillance radar for use on ships over 300 tons. It has a double curvature parabolic antenna enclosed in a radome, an MTI signal processor, and a frequency agile transmitter.

COMPONENTS DIVISION: The Components Division specializes in a range of custom-built components, products, and services (all to military specification):

Printed Wiring Boards - built to customer specifications with emphasis being placed on very complex designs in multilayer boards of up to 24 layers. Boards are made to military and commercial specifications with a high level of quality control. Circuit packaging and photoplatting services are also available.

Microcircuits - designed and produced at CMC include thin film and thick film hybrid configurations, and microwave integrated circuits usable in applications up to 24 GHz. The products include amplifiers, oscillators, mixers, filters, resistor arrays, multipliers, matching networks, as well as many versions of digital circuits, all of which can be tested to full military specifications.

Magnetic Devices - designed and built to customer specifications. They include various types of transformers, filters, delay lines, and power supplies.

Panels and Displays - integrally illuminated panels to MIL-P-7788, and high-brightness, ruggedized alphanumeric displays. New activities include night vision goggle compatible panels and electroluminescent display technology.

Military Power Supplies - designed and produced for aircraft, ground equipment, and missile applications. In-house magnetic, PCB, machining, and power hybrid component production, ensure high-quality and close cost and time control.

Machining - precision machinery to aerospace standards using the latest CNC equipment. A complete range of standard machinery and in-house plating/painting capabilities complement the facility. Mechanical assembly services, spot welding, and plastic injection molded parts are also offered.

COMMERCIAL COMMUNICATIONS DIVISION (CCD): CCD is primarily engaged in Production of commercial grade communications and radar equipment. These devices, however, frequently find application in military operations:

VHF/FM Radio - transmitter-receivers in a frequency range of 138-174 MHz are produced in 4, 6, 8-channel vehicle mounted models with power output of 15 to 30 watts. Base stations have 4, 6, or 8 channels with power output of 2.5, 15, 30, or 70 watts.

UHF/FM Radio - transmitter-receivers are manufactured in two frequency bands, 406-420 MHz and 450-482 MHz. The 4-channel vehicle-mounted models are available with power output of 10 or 30 watts and the 4 channel base stations have 10, 30 or 60 watts output.

HF/SSB Radio - Transmitter, receivers, and transmitter-receivers cover the frequency range 1.6-25 MHz in configurations including manpack portable, vehicle-mounted, and fixed station. Output power varies from 10 watts to 1000 watts and available channels vary from 1 to 16,000 (in the synthesized portable set).

Small Ship Radar - consists only of the LN-66 Marine Radar, originally produced for small coastal fishing vessels, has recently found several new roles in the US Navy and US Army. In its normal 10 KW configuration, it is used on surface patrol craft; with some modifications, it is used as a fire control system; and in the 75 KW version, it is used as a helicopter surveillance radar.

SPECIAL SERVICES DIVISION: The Special Services Division performs a variety of services including the installation, operation, maintenance of equipment, and antennas at large radar and communications sites; repair and overhaul of all types of military electronic systems; repair, overhaul and calibration of electronic test instruments; and repair and calibration of secondary and primary standards, both mechanical and electronic. The Special Services Division has a long history of satisfactory transactions with USAF units.

AVERAGE WORK FORCE: Engineers - 206
Technologists - 240
Others - 2176
Total - 2622

GROSS SALES: 1979/80 - \$107.0M
1980/81 - \$123.0M
1981/82 - \$144.0M

PLANT SIZE: Montreal - 500,000 sq ft
Kanata - 50,000 sq ft

EQUIPMENT: No unique or special equipment

EXPERIENCE: Canadian Marconi Company has provided systems, equipment, components and services to every branch of the US DOD and the US Coast Guard over the past 22 years, meeting all military specifications satisfactorily. The products of CMC, military and commercial, are exported regularly to 94 countries world wide. The company has been granted every Mil Spec available.

KEYWORDS: 1=Aircraft; 3=Avionics; 5=Communications; 7=Electronics;
10=Image Processing & Optics; 12=Machining; 13=Missiles; 15=Radar;
19=Testing/Test Equipment; Doppler Navigation Systems=3;
Omega Navigation Systems=3; Navstar/GPS=3; Engine Instruments=1, 3;
Intelligent Instruments=1, 3; Photogrammetry=10; Data Communications=5, 7;
Tactical Radio Relay=5; Multiplexers=5; Tactical Switchboards=5;
Radio Wire Integrator=5; ECCM Radio=5; Digital Order Wire=5; Power Supplies=1, 7, 13; Radio Ancillaries=5; Adapters=5; Line Terminating Unit=5;
Surveillance=15; PC Boards=7; Circuit Packaging=7; Microcircuits=7;
Thin Film Hybrid=7; Thick Film Hybrid=7; Magnetic Devices=7; Transformers=7;
Displays=1, 3; Illuminated Panels=1, 3; Injection Molding=12; Welding=12;
Precision Machining=12; Radios=5; Repair & Overhaul=3, 7, 19; Calibration=19;
Components=3, 5, 7; Photoplatting=7; Navigation=3.

REVISED: Aug 82.

COMPANY: CANADIAN THERMOSTATS AND CONTROL DEVICES Ltd

CODE: CTC

ADDRESS: 8415 Mountain Sights Ave
Montreal, Quebec, Canada H4P 2B8

CONTACT: Mr. Richard Marquis, General Manager - (514) 739-3274

HISTORY: CanTherm was founded in late 1977 to continue the manufacturing and research program previously carried out by the defunct Multi-State Devices Ltd. They are closely associated with Microtherm GmbH of Pforzheim, West Germany, the leading European manufacturer of bimetallic temperature control devices.

CAPABILITY: With its acquisition of MSD, CanTherm inherited an active R&D department which has continued to expand in many areas of microelectronics and thermal control. Their first order of priority was to finalize the Moxie from a laboratory prototype to a reproducible chip. They have expertise in the fields of metallurgy, vacuum system depositions (sputtering), and semiconductor production techniques as a result of their initial projects. Early on, they were awarded a two year development grant from the Canadian National Research Council to develop a thin film thermister with tolerances $\pm 1\%$ at 25°C . Other specifications included maximum interchangeability and volume producibility at a market acceptable cost. The project was successfully completed within two years and the product is in the North American and European markets.

AVERAGE WORK FORCE: Total - 12

GROSS SALES: No Data

PLANT SIZE: 5,000 sq ft (manufacturing)

EXPERIENCE: CanTherm's product market is world wide. On the North American continent, they work with the Canadian Government, industry, and have an on-going contract with the USAF.

KEYWORDS: 4=Chemistry; 7=Electronics; 9=Environment; Microelectronics=7; Thermal Control=7; Chips=7; Metallurgy=4; Vacuum Deposition=4; Sputtering=4; Semiconductor=7; Thin Film=7; Thermister=7; Environmental Sensor=9; Solid State Devices=7.

REVISED: Sep 82.

COMPANY: CARDION ELECTRONICS/DG INSTRUMENTS
(Division of General Signal Ltd)

CODE: DGI

ADDRESS: Regional Road 5
RR #2
Carp, Ontario, Canada K0A 1L0

CONTACT: John T Dale, Marketing Manager - (613) 839-5710

HISTORY: Formerly operated under the name DG Instruments Ltd, Cardion Electronics/DG Instruments is a Canadian owned company founded by four former employees of Leigh Instruments Ltd and incorporated in Jan 1974. DG Instruments was acquired by General Signal Ltd in February 1982. They report to Cardion Electronics, a unit of General Signal Corp, Woodbury, NY.

CAPABILITY: Cardion/DGI specializes in the design, development, test and manufacture of electronic instruments and systems for both military and commercial applications. Customers are primarily in Air Traffic Control, Avionics, Meteorological Marine, and Hydrographic Services. Systems include solid state ARIS recorder, portable ATC trainer, VOR ground check, solid state anemometer, helicopter air data system, electronic ice measurement, submersible tide gauge, hydrographic navigator, and ships propellor RPM indicating systems.

AVERAGE WORK FORCE: Engineers - 8
Others - 32

GROSS SALES: No Data

PLANT SIZE: 13,800 sq ft

EXPERIENCE: Cardion/DGI has completed a contract with Cubic Corporation to manufacture and test electronic subsystems associated with the ACMR tactical trainer for the CF-18A. They are presently in the first article acceptance test phase of a contract to supply Canadian DND with 27 air control indicators - total value \$4M. Major customers in the Canadian Government include Departments of National Defense; Transport; Fisheries & Oceans; Energy, Mines & Resources; Communications; and Environment.

KEYWORDS: 3=Avionics; 7=Electronics; 20=Miscellaneous; Solid State Devices=3, 7, 20; Recorders=7; Air Traffic Control Simulators=7, 20; VOR Ground Check Systems=7; Anemometer=7; Helicopter Air Data Systems=3; Ice Measurement=7; Tide Gauge=20; Navigation=7, 20; Ship Instruments=7, 20; Tactical Trainer Subsystems=20; Air Control Indicators=7, 20; Instrumentation=3, 7, 20.

REVISED: Sep 82.

COMPANY: CASEY COPTER ACCESSORIES Ltd

CODE: CCA

ADDRESS: P. O. Box 121
Montreal Airport
Dorval, Quebec, Canada H4Y 1A5

CONTACT: Mr. M J Casey, Vice President - (514) 636-6155

HISTORY: Casey Copter Accessories Ltd is a small Canadian owned company founded in 1975 with no other Canadian divisions. There is a US subsidiary that is currently inactive.

CAPABILITY: The sole product of this small Canadian company is the Casey Shroud Heater System. The system is designed for maximum reliability with minimal moving parts and positive mechanical linkages for all controls. This passive heater system is based on the air-to-air heat exchanger principle requiring minimal maintenance. Use of the heater system does not reduce range, restrict airspeed, nor reduce rate of climb because it does not require bleed air or fuel. The heater system will provide a cabin temperature of 15°C at an outside temperature of -40°C, a 30 pound weight saving over combustion heaters, and a high output (over 50,000 BTU/hr). It has proven reliability in Arctic conditions. The Casey Shroud Heater fits all Allison 250 series engines in fixed or rotary wing aircraft. It is Supplemental Type Certified by the US DOT/FAA.

AVERAGE WORK FORCE: Engineers - 3
Others - 6

GROSS SALES: Historical - \$0.8M
Current/Projected - \$0.9M

PLANT SIZE: 2,300 sq ft

EXPERIENCE: The Casey Heater System is currently being used by various departments of the Canadian Federal and Provincial Governments, governments of other countries, US State Governments, Minnesota National Guard, the US Navy, and the US Army (Alaska area). It is estimated that 75-80% of the total sales are to the US (10% to the National Guards). Currently there has never been any sales to the USAF. They are interested in doing business with the USAF.

KEYWORDS: 1=Aircraft; Helicopter Heater Systems=1; Repair & Overhaul=1.

REVISED: June 82.

COMPANY: COLLINS & MOON Ltd

CODE: CAM

ADDRESS: 435 Stone Road W, Suite #215
Guelph, Ontario, Canada N1G 2X6

CONTACT: Mr. George C Moon, General Manager - (519) 836-3844

HISTORY: Collins & Moon Ltd was incorporated in Ontario in mid-1978.

CAPABILITY: Collins & Moon is a computer systems development and sales organization with emphasis on Data Base Management Systems; Software Development; Spatial Information Systems; Numerical and Statistical Analysis, Digital Terrain Analysis and Mapping; Computer Graphics; Hydrologic Analysis and Mapping; Geographic Information Systems; and Thematic Analysis, Mapping and Display.

Collins & Moon has built a library of software on some fundamental ideas about the management and analysis of terrain-related data. For example, a paper by Collins appearing in a 1975 Canadian Surveyor describes an algorithm that provides a complete analysis of a watershed, including the areas and volumes of all potential water storage basins and the boundaries between them. It remains unique in the field of digital elevation model analysis, and several practical simplified methods of watershed analysis have been derived from it. One notable derivative of this algorithm is an extremely fast method of contour drawing that can be applied to dense grid models of nearly one million points.

Prior to incorporation, successive version of THEMAPS were developed. THEMAPS is a program system that derives thematic maps from a variety of input sources using logical or arithmetic algebra. The capabilities of THEMAPS are such that thematic mapping can be supported by simplified data structures. The THEMAPS system, for example, has been applied to mapping the speeds of traverse of army vehicles over varied terrain.

Collins & Moon has completed some unique programs for terrain analysis. An example is a program that finds the intersections of linear features stored in a raster format. This was a problem of long standing in computer cartography and has been solved in an extremely simple and competent way. Other programs determine adjacencies of terrain features.

Another program which was developed ab initio by the company is one that maps the depth-below-line-of-sight for a radar installation. It handles large terrain models in reasonable computer times.

<u>AVERAGE WORK FORCE:</u>	Engineer	- 1
	Agrologist	- 1
	Computer Scientists	- 2
	Others	- 3
	Others available on part-time basis	- 3

<u>GROSS SALES:</u>	1979/1980 - \$0.127M
	1980/1981 - \$0.163M
	1981/1982 - \$0.260M

PLANT SIZE: 800 sq ft

EQUIPMENT: Equipment employed by Collins & Moon include software development connections to Ahmdahl V5 computer; DEC VAX 11/780 computer, VMS operating system; DEC PDP 11 series computers with RSX 11 and UNIX operating systems; PE 32 bit machine running UNIX; Digitizers; Plotters - Applicon, Versatec, Calcomp, Jet-ink; and Monochromatic and Color CRTs currently supporting Tektronix 4050 series and the 4027, Ramtek 6,000 series, Norpak VDP and RDS display systems.

EXPERIENCE: In the areas of data base management, spatial analysis, and geographic information systems, Collins & Moon has completed the first phase of a multi-year contract that calls for the design of a complete spatial analysis system that will include a geographic formation system that will use as major components existing relational and other data base management systems. The system being designed will be called upon to provide interactive input of spatial information, compact and convenient storage of every type of multi-dimensional spatial data, very fast retrieval of some types of data for simulation of strategic and tactical situations and a full range of graphical and CRT display systems. This work is being carried out for the Canadian Defense and Civil Institute of Environmental Medicine.

Collins & Moon has developed a highly competent system of data entry, storage, retrieval and display that contains a powerful query and analysis system that is especially suitable for cartography and thematic mapping. The principal applications to date have been to Vehicle Mobility mapping for the Canadian Forces, and the system is now being applied to environmental mapping for the US Geological Survey. The system is highly interactive and thus can be used by untrained personnel. On the other hand, it provides the frame work of data input, management and display that may be effectively used by experienced scientists in carrying out extensive and complicated terrain analyses. This system accepts data in polygon or raster forms, stores it in well-designed file structures, applies a powerful querying system in logical or arithmetic algebra, provides output data in polygon or raster form (independent of the input format), and creates plot files and display data for computer driven plotters, raster plotters and raster (CRT) display systems of common types.

In the area of hydrology, Collins & Moon has completed work for the Ontario Department of Natural Resources. During the course of their work in the hydrographic analysis area, the company analyzed digital elevation models in dense grid format and the work was supportive of hydrological terrain assessment. The analysis of dense-grid digital elevation models, the methods of creating such models, are particular fields of expertise of the company. Software has been developed that carried out a complete watershed analysis from such a model, providing watershed boundaries, saddle points, runoff contributing areas, volumes and areas of water storage, flow quantities and drainage patterns, and other parameters.

Digital Elevation Model techniques have been developed and exploited for drawing contours, slope maps, maps of obstructions to vehicles, and Radar Masking (hidden ground and air space) maps. Programs have been developed for creating Digital Elevation Models from contours and characteristic lines, and a number of new algorithms for this purpose are now the subject of research. Programs have been delivered to the Canada Center for Remote Sensing that attach elevations to each of the pixels of Landsat imagery.

Collins & Moon has created and implemented programs for attaching thematic information, derived from line-drawn maps to pixels of Landsat images; and for the converse process, converting the pixels of a processed Landsat image into polygonal format for hard copy cartography and for CRT display. Together with their thematic mapping programs, these programs effectively unite Landsat imagery directly with classical cartography, allowing the same methods of basic data management for both.

Collins & Moon has carried out projects for the Air Operations Research Branch of the Canadian Department of National Defense and for the Defense Research Establishment (Suffield). These projects involved the development of a program to produce maps of terrain visible from a long range radar, data base systems for terrain data computation and map production and a study for the creation and implementation of software for terrain analysis and display.

KEYWORDS: 6=Computers; 8=Energy; 9=Environment; 10=Image Processing & Optics; 15=Radar; 17=Software Services; 20=Miscellaneous; Mapping=8, 9, 10, 15, 17, 20; Data Acquisition=8, 9, 10, 15, 17, 20; Data Processing=8, 9, 10, 15, 17, 20; Interactive Processing=17; Geologic Analysis=8, 9, 17, 20; Geographic Analysis=8, 9, 17, 20; Thematic Analysis=8, 9, 10, 15, 17, 20; Thematic Mapping=8, 9, 10, 15, 17, 20; Thematic Display=8, 9, 10, 15, 17, 20; Software Development=17; Geographic Information Systems=8, 9, 17, 20; Computer Graphics=17; Digital=8, 9, 17, 20; Spatial Information Systems=9, 17; Numerical Analysis=17; Statistical Analysis=17; Systems Development=6, Terrain Analysis=8, 9, 10, 15, 17, 20; Hydrologic Analysis=8, 9, 17, 20; Hydrologic Mapping=8, 9, 17, 20; Data Management=8, 9, 10, 15, 17, 20.

REVISED: Nov 92.

COMPANY: COMINCO Ltd
(Electronic Materials Division)

CODE: COM

ADDRESS: Cominco Ltd
Trail, British Columbia, Canada V1R 4L8

Cominco Electronic Materials Inc
E 15128 Euclid Ave
Spokane, Washington 99216

CONTACT: (Canada) H E Hirsch, Manager, Technical Research - (604) 364-4426
(Canada) R F Redden, Development Superintendent - (604) 364-4751
(US) D L Guettinger, Manager, CEMI Sales - (509) 922-8614

HISTORY: Cominco Ltd was incorporated in 1906 and is 91% Canadian owned. Other Canadian locations include - a Head Office at 200 Granville St, Vancouver, British Columbia V6C 2R2; Group Offices in Trail, British Columbia - Calgary, Alberta - Yellowknife, NWT; and Research Centers in Trail, British Columbia and Sheridan Park, Ontario. Other US locations (Electronic Materials) can be found in California - Chicago, Ill - and Hartford, Conn.

CAPABILITY: Cominco is the world's largest producer of zinc and lead with significant output of many by-product metals and chemical fertilizers.

Electronic Materials Division Production:

- . High Purity Metals - 17 different metals each in several degrees of high purity and shapes.
- . High Purity Arsenic - 49 to 79 grade arsenic in various allotropic crystal forms and shapes. Largest plant of its kind in the world.
- . Semiconductors - single crystal boules and polished wafers of gallium arsenide, indium antimonide, cadmium telluride, cadmium mercury telluride, gallium antimonide and indium arsenide.
- . High Purity Metals Fabrication - alloying, casting, rolling, extrusion, stamping and machinery operations to produce semiconductor processing and packaging materials e.g., evaporation charges, sputtering targets, solder preforms, bonding wires, and ribbons. A well equipped precision tool and die shop serves both Production and Development.

Electronic Materials Division Development:

R&D is directed toward new metal/metal compounds and semiconductor processes, product advancement, and production equipment.

AVERAGE WORK FORCE: Whole Company - 12,300
Electronic Materials Div - 210

Electronic Materials Div
(Trail, British Columbia)

Engineers - 9
PhDs - 3
Machinists - 3
Others - 45

(Spokane, Washington)

Engineers - 12
PhDs - 4
Machinists - 3
Others - 131

GROSS SALES: 1980 - \$1,423M (Whole Company)
1980 - \$ 55M (Electronic Materials Div)

PLANT SIZE: Electronic Materials Division
(Trail, BC) - 70,000 sq ft
(Spokane, WA) - 80,000 sq ft

EQUIPMENT: Melbourne high pressure Czochralski Crystal Grower; custom built metal refining equipment; custom built crystal slicing, fabrication and polishing facilities; and high purity metals fabrication equipment.

EXPERIENCE: Cominco has been in the electronic materials business since 1949 and has supplied materials to most major US electronic companies.

KEYWORDS: 4=Chemistry; 7=Electronics; 20=Miscellaneous; High Purity Metals=4; Compound Semiconductor Wafers=4, 7; Semiconductors=4, 7; Infrared Materials=7; Bonding Wire & Ribbons=20; Sputtering Targets=7; Solder Preforms=7; Evaporation Charges=4; Metallurgy=4; Semiconductor Wafers=4, 7.

REVISED: Jul 82.

COMPANY: COMPUTING DEVICES COMPANY

CODE: CDC

ADDRESS: P. O. Box 8508
Ottawa, Ontario, Canada K1G 3M9

CONTACT: Mr. Jack G Warner, Dir, International Marketing - (613) 596-2840

HISTORY: Computing Devices is a high technology company that has been a division of Control Data Canada Ltd since 1969. The company was established in 1948 and has a UK subsidiary, Computing Devices Co Ltd. It is also involved in the manufacture and supply of advanced electronic systems. The company maintains sales representatives in over twenty-three countries.

CAPABILITY: Computing Devices' technology areas include signal processing systems for airborne, shore and undersea vehicles, digital ballistic computer systems for vehicle & portable installations, air navigation display systems, stores management systems for aircraft, electronic intrusion detection systems, command & control display systems for ships, jet engine thrust measurement systems, and air defense systems. Specifically, the company developed, and is manufacturing an acoustic data processor (Preselectable Mainband Processor, PMP-8). This ASW system is designed for monitoring omnidirectional passive sonobuoys from aircraft. The company also has similar acoustic processing ASW equipment in airborne platforms with the Royal Air Force and the Royal Australian Air Force. Another system, the Standard Multi-Sensor Digital Display, is designed for the Canadian Navy use under the concept of Shipboard Integrated Processing and Display System. They have also developed a Microprocessor Digital Computer System according to a Chrysler specification for the fire control system of the M-1 main battle tank. They have produced approximately 500 systems at this time. Their Projected Map Display is for use in a variety of aircraft from tactical fighters and helicopters, to supersonic transports. This system has been used on the US Navy A-7 aircraft for over 8 years and has been accepted for the USAF Pavelow III Rescue Helicopter Program. The S67 Blackhawk helicopter is also equipped with this system. The company is now working on a small projected map display for evaluation by the US Army and for the German Army. They are currently involved in the shared development Ported Coaxial Cable Sensor Program with the BISS SPO at Electronics Systems Division (ESD). The program goal is to develop and test buried cable detection systems for outside security application. The program start date was mid-1976 and is currently in the FSED phase. Initial production deliveries for DOD requirements are scheduled for the 1983-89 time frame. The program has had many spinoffs. GUIDAR is their commercial product. They also developed a system (Thrust Computing System) to compute (from measured pressures) the gross thrust of afterburning turbojet and turbofan engines. The technology has been proven in NASA high altitude test cells on the J85, J79, TF30 and F100 engines, and on the T38/J85-5 system on the Edwards AFB thrust stand. A maintenance application of the technology has been adopted by the USAF for its Air Training Command T-38 fleet for installed engine trimming on the flightline called Thrust Computing Support Equipment (TCSE). NASA is also using the technology in the HIMAT program. This was also a shared development program between the USAF and the Canadian Government completed in late 1978. Their design, development and production capabilities have been effectively demonstrated. They perform to military specifications. Contract manufacturing (offset business) accounts for 25% of

their business. This is accomplished for Hughes Aircraft Company for the joint Surveillance System.

AVERAGE WORK FORCE: Professionals - 225
Total - 850

GROSS SALES: \$54M (Historically)
\$58M (Current)
\$80M (Projected)

PLANT SIZE: 295,000 sq ft (three buildings)
400 acres (Stittsville Research Facility)

EXPERIENCE: As seen under Capability Section, CDC has experience with the US military (approx 50% of their total sales). They have considerable production capability.

KEYWORDS: 1=Aircraft; 3=Avionics; 6=Computers; 7=Electronics; 15=Radar; 16=Security & Safety; 20=Miscellaneous; Cockpit Displays=3; Data Handling=1, 3, 7; Data Analysis=1, 3, 7; Engine Controls=1; Flight Data Recorders=1, 3; Voice Recorders=1; Instruments=1, 3; Navigation=1, 3, 15; Performance Measuring Device=1; Engine Thrust Measuring Device=1; Acoustic Sensing=7, 20; C3 Systems=7, 20; Computer Systems=3, 6; Computer Parts=6, Data Acquisition=1, 3, 7, 20; Repair & Overhaul=3, 6, 7; Video Display Systems=3, 7, 20; Voltage Transformers=7; Regulators=7, Projected Map Displays=1, 20; Intrusion Detection=16, Signal Processing Systems=1, 20; Ballistic Computer Systems=20; Stores Management Systems=1; Air Defense Systems=20; ASW System=1 20; Fire Control System=20.

REVISED: Oct 82.

COMPANY: CTF SYSTEMS Inc

CODE: CTF

ADDRESS: 15-1750 McLean Ave
Port Coquitlam, British Columbia, Canada V3C 1M9

CONTACT: Dr Max B Burbank, President - (604) 941-8561

HISTORY: CTF Systems is a high technology company created in 1970 by a group of young physicists from Western Canada. The primary goal of the company over the past decade has been the development and manufacture of instrumentation and systems allied to the fields of electronics and applied physics. This goal has materialized through various R&D contracts into three main areas of expertise:

- . Cryogenic & SQUID (an acronym for Superconducting Quantum Interface Device) Technology.
- . Ultrasonic Non-Destructive Evaluation (NDE).
- . Applied Microprocessor Technology.

CAPABILITY:

1. Cryogenic and SQUID Technology - CTF Systems has developed and/or advanced the technology through innovation in several areas of cryogenics and SQUID magnetometry. These areas include:

a. Cryogenic liquid containers (Dewars) with unusual designs such as:

- (1) Horizontal Dewar - a mobile, random orientation liquid Helium cryostat, suitable for airborne tests and designed to accommodate a 9-component gradiometer/magnetometer array using SQUID sensors.
- (2) Large Access Vertical Dewar - a non-magnetic, non-metallic 12 inch diameter dewar for ground testing the 9-component SQUID array.
- (3) Room Temperature Access Dewar - a two dewar combination with an "inverted" inner dewar to permit rock samples to be measured at room temperature inside a superconducting coil assembly.

b. SQUID Sensor Design - The SQUID is a ultrasensitive cryogenic device which exploits two properties of superconductors - the Josephsen effects in tiny superconducting junctions and the quantization of magnetic flux in closed superconducting loops. A complete CTF SQUID systems consists of a superconducting flux transformer; a basic SQUID sensor; RF amplifier/detector and analog feedback circuitry; and circuitry to digitize, filter, resample and transmit data to recording or signal processing equipment. The superconducting flux transformer (which is noiseless) can enhance the basic sensor flux sensitivity by a factor of 50 or more with true DC response. By appropriate configuration of this flux transformer, the SQUID system can sense specific magnetic field vectors, or 1st, 2nd, or 3rd spatial gradient tensor components. A number of specialized flux transformers have been designed and constructed by CTF in recent years, including the following advanced

magnetometer systems:

(1) Airborne Gradiometer - a 9-channel SQUID system (6 gradient tensor and field vector components) suitable for mobile applications was designed and developed. Design work was guided by computer simulation to minimize intercomponent interference.

(2) High Sensitivity Magnetometer - a 3-component vector magnetometer with a resolution of $10E-10$ gauss rms/SQR(Hz) with a 9-decade dynamic range.

(3) Third Order Biogradiometer - a biomagnetic sensor/dewar combination designed to detect the third spatial gradient with a high sensitivity only to very near sources, rejecting more distant ones. Low frequency (0.3 Hz) signals of the order of $10E-10$ gauss from the brain and other organs are detectable in the presence of more distant magnetic noise sources many orders of magnitude higher. A publication describing the Biogradiometer and its operations is available from CTF Systems Inc.

c. Digital SQUID Electronics - CTF is the only SQUID manufacturer presently making a digital SQUID control module capable of remote computer control of data sampling, digital filtering, and data transfer. Special features of this instrument, the DSQ-400, include a 9-decade dynamic range, a sophisticated second order digital filter with transient protection, and multichannel sampling synchronized to within 30 nanoseconds between channels. Up to 32,000 32-bit measurements per second can be recorded from each channel, and up to 15 channels controlled via one 16-line parallel computer I/O port. The DSQ-400's digital format and synchronized sampling permit multi-channel sensing with high temporal coherence. This makes possible advanced gradiometer compensation systems and the virtual elimination of coherent noise (e.g., 60 Hz) from data, without phase distortion or spectral gaps as with analog filter circuits.

2. Ultrasonic Non-Destructive Evaluation (NDE) - CTF has been active in this field since 1975, carrying out research and development on behalf of the Canadian Department of National Defense with regard to a number of NDE problems. Projects of major importance include:

a. Naval Boiler Corrosion - a 3-mode system (manual to fully automatic) has been developed for rapid, thorough scanning of boiler tubes. The Model NDE-2 Analyzer contains a microprocessor which controls mechanical probe motion, data acquisition, storage and output, and features an ultrasonic transducer yielding clean unambiguous signals in small diameter tubes. Probe range is up to 8 feet (2.5m).

b. Acoustoelectric Transducer - a new phase-insensitive transducer has been developed for quality assurance applications in producing new high performance composites used in military aircraft. This new semiconductor transducer shows great promise for future routine aircraft inspection for micro-cracks and delaminations, and appears to be free of phase-related signal washout problems which plague piezoelectric transducers. Development of a production prototype is expected in the near future.

3. Applied Microprocessor Technology - Microprocessors have been exploited by CTF as an effective means of implementing complex measurement and control functions automatically and with minimal chance of human error. Systems which have resulted from this approach include - the NDE-2 Ultrasonic Tube Analyzer (described above); the XDC-1 (a portable dive support decompression calculator, which monitors and models various metabolic parameters using the "Kidd-Stubbs" hyperbaric exposure model); several instruments based on the XDC-1; and an automated SQUID rock magnetometer (being developed for the Department of Energy, Mines & Resources).

As a result of much of the work undertaken in the past decade, CTF expertise in advanced signal processing techniques has grown considerably, and is now a major factor in the company's overall capability in data acquisition and software systems design.

<u>AVERAGE WORK FORCE:</u>	PhDs (Physics)	- 4
	Engineers	- 3
	BSc (Physics)	- 4
	Technical & Other	- 15
	Total	- 26

GROSS SALES: 1981 - \$1.2M

PLANT SIZE: 9,600 sq ft

EQUIPMENT: CTF has a variety of general and specialized equipment and facilities necessary for electronic and cryogenic/NDT R&D. Some of the equipment/facilities are listed below:

Computer Facility:

- . PDP 11-34; Dual 5Mb hard disks; 320 Mb Winchester; RSX-11m software
- . PDP-8 E Intersil micro-6100 microprocessor development system

Electronic Equipment:

- . Signal Generators (Audio, R.F.)
- . Amplifiers (D.C., Audio, R.F.)
- . Digital Multimeters
- . Digital Counter/Timer
- . Digital Logic Analyzer
- . 10'x10'x8' RF Shielded Room
- . Spectrum Analyzer
- . Lock-in Amplifiers
- . Microvoltmeters
- . Oscilloscopes
- . Power Supplies
- . Filters, Mixers, Attenuators
- . PC Board Assembly
- . Wire Wrap Assembly

Cryogenic Equipment:

- . Helium Leak Detector
- . 100 Liter LHe Storage Dewar (2 units)
- . 60 Liter LHe Storage Dewar
- . LHe Transfer Lines

- . Non-Metallic LHe Dewar Fabrication Facility
- . Non-Metallic LHe Test Dewars

NDT Ultrasonic Facility:

- . Multiple Frequency Ultrasonic Generator/Signal Conditioner/Receiver
- . NDT Transducer Sensor Construction Facility
- . Test Standards

Mechanical Equipment:

- . Equipment necessary for in-house fabrication of most required items

General Equipment:

- . Three Axis Helmholtz Coil (2m dia)
- . Vacuum Deposition System (Fore-Pump, Diffusion Pump, Vacuum gauge to 10E-9 torr, High Current Heater Supply, High Voltage DC Sputtering Supply)
- . Chemical preparation room with fumehoods and drybox
- . Three Axis Micropositioners
- . Shielded Room Facility

Special Test Facilities:

- . A low magnetic gradient, low magnetic noise field test facility with associated instrumentation building
- . High-order biogradiometer test and balancing facility

EXPERIENCE: CTF defense related experience has been primarily with the Canadian Department of National Defense. CTF has fulfilled more than 25 contracts with DND and with other Government agencies since 1971. CTF personnel also enjoy an active technical relationship with two local universities. Several dozen commercial systems and components have been sold to universities, governments, oil companies, hospitals, and research facilities around the world.

KEYWORDS: 1=Aircraft; 6=Computers; 7=Electronics; 16=Security & Safety; 17=Software Services; 19=Testing/Test Equipment; 20=Miscellaneous; Cryogenics=7, 20; Superconductors=20; SQUID Instrumentation=16; Magnetometers=16; Gradiometers=16; Biomedical Instruments=20; Ultrasonics=19; Non-Destructive Evaluation=19; Acoustoelectric Transducers=1, 19, 20; Composite Evaluation=1, 19, 20; Microprocessor=6, 7, 20; Automatic Measurement Systems=7, 17; Signal Processing=16, 17; Applied Physics=20; Dive Support Instruments=20; Cryogenic Liquid Containers=20; Dewars=20; Super Conducting Quantum Interference Device=16; Digital Squid Control Module=16; Magnetic Anomaly Detection=3, 16; Metal Evaluation=19.

REVISED: Oct 82.

COMPANY: THE D & D GROUP Inc

CODE: DDG

ADDRESS: Village Square Mall
P. O. Box 372
Smithville, Ontario, Canada L0R 2A0

CONTACT: Mr. Thomas W Drew, president - (416) 957-3323
Mr. Gordon Evans, General Manager (phone same as above)

HISTORY: The D & D Group is comprised of four Canadian companies and one US company, all involved in various environmental and pollution control activities. The oldest of the companies was incorporated in 1967. Two Canadian companies are located in Smithville, Ontario; one in Hamilton, Ontario; and one in Edmonton, Alberta. The US firm is located in Buffalo, NY.

CAPABILITY: The Group specializes in processing toxic waste materials as well as developing new techniques and processes for recycling and material handling.

Some of the Special Purpose systems developed and/or undergoing final tests are:

- . Mobile Diesel System for the conversion of PCB liquid
- . Distillation of Trichlorobenzene (TCB) from PCB fluids
- . Mobile system to remove PCBs from contaminated transformer oil
- . Recovery of precious/semi-precious metals from wastes and river beds

AVERAGE WORK FORCE: Total - 30

GROSS SALES: \$1.5M - \$2M

PLANT SIZE: The three Canadian sites combined have in excess of 5,000 sq ft of buildings, with three acres of open storage.

EQUIPMENT: In addition to the special equipment outlined in the Capabilities Section above, the company operates special purpose high vacuum vehicles for handling wet and dry materials.

EXPERIENCE: Recent major projects completed include:

- . PCB cleanup and disposal for Canadian Pacific Railway/Ministry of Environment.
- . Building decontamination for Toronto Hydro.
- . Retrofill PCB transformers for Department of National Defense, hospital, institutions, power authorities and private industry.

The D & D Group are commonly referred to as "The Problem Solvers" and are regularly called upon for information and assistance by insurance companies, industries and various levels of government from across Canada to resolve their environmental problems and cleanup emergency spills.

KEYWORDS: 9=Environment; Toxic Waste Processing=9; Environmental Control=9;
Pollution Control=9; Material Handling=9; Recycling=9; Process Development=9;
PCB Destruction=9; TCB Recovery=9; Mobile Recovery System=9;
Contaminated Transformer Oil=9; Transformer Oil Substitute=9;
Precious Metal Recovery=9; Metal Recovery=9; Cleanup=9; Decontamination=9;
Retrofill=9; Chemical Spill Cleanup=9.

REVISED: Jul 82.

COMPANY: DATA IMAGES Inc

CODE: DII

ADDRESS: 1283 Algoma Road
Ottawa, Ontario, Canada K1B 3W7

CONTACT: Ms. Debbie Blanchard, Customer Sales Mgr - (613) 744-3773

HISTORY: Data Images was incorporated in 1979 and is Canadian owned.

CAPABILITY: Data Images Inc designs and manufactures high reliability custom LCDs. They have proven expertise in high level multiplexing and meeting extreme environmental specifications. Their R&D staff is comprised of 2 PhDs in Physics/Electronics, 1 Phd in Organic Chemistry, and 3 technical support staff.

AVERAGE WORK FORCE:

Engineers	- 6
PhDs	- 3
Machinists	- 3
Mgmt/Admin	- 10
Production	- 20
Drafting	- 3

GROSS SALES: \$1.0M (Historical)
\$1.5M (Present)
\$3.0M (Forecast)

PLANT SIZE: 10,000 sq ft (Production)
3,000 sq ft (R&D)
5,000 sq ft (Admin)
18,000 sq ft (Total)

EXPERIENCE: Data Images has experience with Sperry Flight, Bell Helicopter, and the US Army (Multiplexed Multiline Cockpit Display for AHIP); American Liquid Xtal and Hughes Aircraft (Static 2 line Alpha Numeric Display); and is also involved in military development projects with Marconi Space & Defense (UK), L M Eriksson (Sweden), Grimes (US), and Plessey West Leigh (UK).

KEYWORDS: 3=Avionics; 7=Electronics; Liquid Crystal Displays=3, 7; Displays=3, 7; Multiplex Displays=3, 7; LCDs=3, 7.

REVISED: Nov 82.

COMPANY: THE DeHAVILLAND AIRCRAFT OF CANADA Ltd

CODE: DHC

ADDRESS: Garratt Blvd
Downsview, Ontario, Canada M3K 1Y5

CONTACT: Mr. J W Sandford, President - (416) 633-7310

HISTORY: DeHavilland Aircraft of Canada was established in 1928 as a sales outlet, assembly plant, and maintenance facility for aircraft of the British parent company's design and manufacture. The company is owned by the Canadian Government. Its main plant is located in Downsview, Ontario, with other offices located in Ottawa; Washington, DC; and Rosemont, Illinois.

CAPABILITY: DeHavilland Aircraft of Canada is a designer and manufacturer of both civilian and military aircraft. It is a leader in short takeoff and landing (STOL) aircraft technology, and is actively engaged in the design and manufacture of these aircraft. During the time period 1939 - 1945, the company built over 3,000 Mosquito bombers, Tiger Moth, and Anson trainers. Following this time, they designed and built the Fox Moth and later the DHC-2 Beaver. More than 1,600 of these latter aircraft were built for use in Canada, the US, and world-wide locations. Their work on the Beaver pioneered the concept of STOL. This aircraft was followed by the DHC-3 Otter and the twin-engine DHC-4 Caribou.

In the early 1960s, DeHavilland combined the turbine power technology with their STOL technology and began to turn out the Buffalo, Twin Otter and Dash 7 aircraft. Today, engineering development is well underway on the DHC-8. This is a 32-36 passenger/cargo aircraft demonstrating STOL capabilities, fuel efficiency, and rapid conversions between passenger/cargo configurations.

In the R&D area, DeHavilland has designed and tested many two and three dimensional (airfoil section) wind tunnel models in various low speed wind tunnels. The tunnels mainly used are those operated by the National Aeronautical Establishment in Ottawa. This type of work has led to the development of an advanced powered lift system known as the Augmentor-Wing. A large Augmentor-Wing model incorporating a unique self-contained load compressor to provide large quantities of relatively cool air for test purposes was designed, built, and has been successfully tested in the 40 ft x 80 ft wind tunnel at NASA/Ames. At this time, a converted Buffalo incorporating the DeHavilland Augmentor-Wing concept has completed over 700 hours of flight test research covering all aspects of STOL technology, airworthiness, handling and control, instrumentation, avionics, navigation, etc. They also designed and manufactured the complete power plant nacelle package that was incorporated in to the Augmentor-Wing Flight Test Vehicle.

<u>AVERAGE WORK FORCE:</u>	Engineers	- 112
	Machinists	- 103
	Tool & Die Makers	- 172
	Technicians	- 250
	Support Staff	- 133
	Others	- 4630

GROSS SALES: (To 31 May 81): \$70M (Domestic); \$280M (Export).

PLANT SIZE: 1,600,000 sq ft (Manufacturing Floor Space)

PLANT SIZE: 93,000 sq ft (Offices)

EQUIPMENT: For many years the DeHavilland plants have been engaged in the production of stressed skin aluminum alloy airframes, and in doing so, utilize equipment normally found in a well-equipped aircraft manufacturing complex. Their present shop equipment includes milling machines; engine, turret, and pre-programmed automatic lathes; drill presses; drop hammers; punch, hydro and stretch presses; magneform; shapers & rolls; joggers; tube bending and swaging machines; precision grinders; planers; multi-spindle routers; spot and heli-arc welders; vertical and jig borers; and broaches and shears. In addition, heat treat, foundry, plating, painting, sandblasting, and other treatment equipment is available. Hydraulic, instrument, radio, plastic, and upholstery shops also form part of the complete facility. The wood working shop specializes in the manufacture of wind tunnel models, patterns, and mock-ups. Numerically controlled equipment includes a drafting and digitizing machine, and several multi-spindle profile mills, one of which has a machine table measuring and marking machine. Many of the elements of a CAD/CAM system are presently in existence at DeHavilland. Interactive graphics are currently used for detailed layouts of sheet metal and machine items. They also have a pair of Dual Gantry 3-Spindle, 5-Axis Vertical Profilers.

DeHavilland also maintain an Engineering Library, Metallurgical Laboratory, an Aerodynamics Laboratory, a Structural Testing Department, a Materials Research Laboratory, Environmental Chambers, and an Engineering Computer Center. In addition, an Engineering Development Shop, housed in a separate 11,000 sq ft building, consists of 100 skilled tradesmen experienced in working directly with the Engineering staff. Their Data Center contains an IBM System 4342/2 model digital computer with 8 mega bytes capacity. Finally, their Engineering Department has recently acquired a VAX II Computer which is fully operational.

EXPERIENCE: Contracts for both aircraft purchases, and research & development programs have been negotiated with the USAF, NASA, US Department of Interior, USAF Academy, Alaska National Guard, Canadian Forces, Canadian National Research Council, and the Canadian Department of Transport. In addition to the above, the DeHavilland product line is presently being operated in over 70 countries world-wide and on all seven continents. Previous DOD contracts include:

- . 981 L20 DHC-2 Mk1 Beaver aircraft to the USAF/US Army.
- . 165 DHC-4 Caribou aircraft to the US Army.
- . CV7A Buffalo aircraft development.
- . SC8A Air Cushion Landing System.

KEYWORDS: 1=Aircraft; 3=Avionics; 12=Machining; Aircraft Control=1; Air Delivery Systems=1; Airframe Components=1; Airframe Structures=1; Cargo Handling Equipment=1; Cockpit Displays=3; Composite/Fiberglass Components=1; Data Handling=1; Data Analysis=1; Drones=1; Engine Components=1; Engine Systems=1; Engine Controls=1; Environmental Controls=1; Fuel Systems=1; Fuel Research=1; Hydraulics=1; Instruments=1; Landing Gears=1; Navigation=1; Performance Measuring Devices=1; Personnel Survival/Restraint=1; Repair & Overhaul=1; Simulators=1; Training=1; STOL Aircraft Manufacture=1; Wiring=1; Tubing=1; Augmentor Wing=1; Extended length=12.

REVISED: Oct 82.

COMPANY: DIEMASTER TOOL Inc

CODE: DIE

ADDRESS: 160 Watline Avenue East
Mississauga, Ontario, Canada L4Z 1R1

CONTACT: Mr. G W Duncan, Marketing & Special Projects - (416) 273-7111

HISTORY: Diemaster is a Canadian owned company that has been in business for 10 years.

CAPABILITY: Diemaster is a precision machining firm specializing in machining to aerospace, military and nuclear standards, jig boring, CNC machining, EDM machining, turning, and milling. They perform stamping operations from 16 to 500 metric tons. Diemaster also designs and fabricates production tooling, special purpose machines, jigs, fixtures, gauges, and dies. Their quality control meets CSA-Z-299.2, DND 1016 and MIL-I-45208A.

AVERAGE WORK FORCE: Total - 102

GROSS SALES: \$5 - \$6M

PLANT SIZE: 66,000 sq ft

EQUIPMENT: NC & CNC machines, CNC machining centers, and computing centers. Other typical equipment includes mills, grinders, borers, milling machines, drills, lathes, pantograph, presses, and cutting, finishing and inspection equipment.

EXPERIENCE: Diemaster customers include TRW, Avco Lycoming, Sanders' Associates, Dupont, Orenda Engines, Bombardier, IBM, McDonnell Douglas, Pratt & Whitney, Xerox, Rockwell International, RCA and many more well known companies. Products to these companies have included aircraft engine parts, fuel tanks, critical components for aircraft navigation systems, components for nuclear industry, dies, gauges, test and production centers, and stampings.

KEYWORDS: 12=Machining; Precision Machining=12; CNC Machining=12; Boring=12; Turning=12; Milling=12; Stamping=12; Fabrication=12; Design=12; Die Fabrication=12; Gauges=12.

REVISED: Jul 82.

COMPANY: DIFFRACTO Ltd

CODE: DIF

ADDRESS: 6360 Hawthorne Drive
Windsor, Ontario, Canada N8T 1J9

CONTACT: Mr. T R Pryor, President - (519) 945-6373

HISTORY: Diffracto Ltd was incorporated in 1973 as an off-shoot of work done at the University of Windsor. The company is Canadian controlled with a 20% interest owned by Otto Wolff AG of Cologne, Germany. An Otto Wolff subsidiary, Hommelwerke, is also the distributor of Diffracto products in Europe. They also have a US subsidiary, Diffracto Ltd, located at 19640 Harper, Grosse Point Woods, Michigan 48236. Most of the business of the company is conducted in the US through the US subsidiary which largely acts as a sales and service operation.

CAPABILITY: Diffracto has been a pioneer in the application of electro-optical inspection equipment to the manufacturing industry, primarily automotive, but also including nuclear, turbine engine, bearings, ordnance, and the like. These electro-optical units were originally developed on a custom basis, but are increasingly becoming more and more standardized. Many are finding their way into robotic applications and a separate subsidiary is being formed to handle these applications, including both inspection and robot guidance with visual sensing capabilities.

Diffracto currently produces a variety of standard sensor products. In addition are certain special machines, the most predominant example is the Programmable Airfoil Contouring System (PACS) for turbine blade inspection. The PACS was originally developed as a joint Canadian/US Defense Development Sharing project with the USAF (AFWAL/MLTM), General Electric, and Diffracto. This particular project has led to the sales of several such machines to manufacturers of blades in the US and is subject of intense current interest relative to both the inspection of new and rework blades (where additional Diffracto flaw detection equipment can be combined into such machines). An off-shoot of the PACS is the Laser Gear Inspection Machine. It is touted as offering a revolutionary way of quantifying gear dimensions in minimal time.

Diffracto has devoted considerable effort to R&D activities and has received support in this area from the National Research Council of Canada, and the Department of Industry, Trade and Commerce. Current projects exist in the following areas:

- . Electro-optical flaw detection
- . E/O sorting machine development
- . High resolution sensor development (profile image and triangulation)
- . Robot guidance sensor development
- . Fiber optic dimensional and CMM probe development
- . Electro-optical sensors for machine tool feedback

In addition to the above, there are numerous customer sponsored projects and smaller internal projects. It should also be noted that a large percentage of their custom inspection machines delivered have substantial sensor R&D components. The company currently performs over one million dollars of R&D per year directly aimed at laser and electro-optical sensor development for

measuring, inspection and robot guidance. Major applications for this type equipment within private industry and possibly within the USAF are as follows:

- . Inspection and automatic adaptive control of turbine blade manufacture and rework.
- . Inspection of turbine assemblies and components. For example, they have projects underway with General Electric for inspection of rotor shaft internal defects. Previous projects were concerned with tip clearance on rotors and for the automatic ultrasonic inspection of disks (laser/optical sensor control portion).
- . Air frames and components.
- . Diffracto has participated to a small degree with Boeing in the ICAM sheet metal center development program. Much of the hardware needed to actually implement such a center from the inspection and robot control point of view, already exists at Diffracto. They are currently in discussions with Lockheed Georgia on this same subject.
- . Structural Integrity - Diffracto has completed laser-based, miniaturized strain gage for aircraft fatigue strain history monitoring for the Canadian Department of National Defense. This gage can be used for highly stressed air frames and gives real time as well as stored data directly in digital form. It can exist in a fiber optic based version having very low weight and freedom from electrical noise.
- . Manufacturing Technology - applications include the inspection of parts on flexible machining centers and the inspection of tools in the changers.
- . Ordnance - Diffracto inspection systems can be used for the inspection of ordnance. These normally high volume, high tolerance items require both dimensional and defect inspection, and are therefore ideally suited for electro-optical inspection. Some Diffracto sensing systems operate with fiber optics and can be utilized in remote areas, e.g., loaded munitions areas, etc. Sensors already exist for large caliber barrel straightness determination. Barrel bore dimensions and flaws are other areas for which sensors have been developed. Miniaturization of this technology to small caliber barrels (5.56mm to 40mm) has proved successful.
- . Inspection of rivet and fastener holes in aircraft skins - Diffracto has a bore probe system that can contour holes optically without requirement for all the channels of information needed in a capacitance probe.

Diffracto standard products include:

- . Standard Laser/Electro-Optical Sensors
 - . 'MAXAN' Matrix Array Computer Vision Units
 - . Series S and D High Resolution Outer Diameter Sensors
 - . 'LaserProbe' High Resolution Laser Triangulation Sensors

- . LaserSurf In-line Microfinish Sensors
- . Model SF and BF Surface and Bore Flaw Detection Equipment
- . K-Series Microcomputer Based Controller for Optical Sensors and Machines
- . Contact Optical Digital Bore Size Probes
- . Standard Machines
 - . PACS - Programmable Laser Airfoil Contour Systems
 - . Laser Gear Inspection Machine
 - . 'OptoSorter' Computer Vision Bolt Sorting Machine
- . Computer Controlled Marking Units
 - . Model 400 Laser Marker for Part Identification
 - . 'TurboJet' Ink Printer

AVERAGE WORK FORCE: Total - 100 (5 PhDs)

GROSS SALES: FY 81 - \$5.5M
FY 82 - \$6.5M (projected)

PLANT SIZE: 66,000 sq ft

EXPERIENCE: Diffracto has performed one contract with the USAF (AFWAL - Materials Laboratory) through the Defense Development Sharing Program. They have worked with the US Army (Picatinny Arsenal) as well as with US industry, e.g., General Electric Co., Boeing Aircraft Co., Union Carbide, Uniroyal, Westinghouse, Bunker-Ramo, Battelle, and others. They also work with the Canadian Department of National Defense and National Research Council of Canada.

KEYWORDS: 1=Aircraft; 7=Electronics; 10=Image Processing & Optics; 12=Machining; 19=Testing/Test Equipment; Measurement & Control Systems=7, 19; Laser Optics=10, 19; Optics=10, 19; Automated Precision Measuring=12, 19; Precision Measuring=12, 19; Inspection Equipment=10; Ordnance Inspection Equipment=10; Sensors=19; Turbine Blade Inspection=1, 7, 10, 19; Gear Inspection=10, 19; Flaw Detection=10, 19; Structural Integrity=1, 10, 19.

REVISED: Jul 82.

COMPANY: DIPIX SYSTEMS Ltd

CODE: DIP

ADDRESS: 1785 Woodward Dr
Ottawa, Ontario, Canada K2C 0P9

CONTACT: Mr. L J Robert, Dir of Marketing - (613) 224-5175

HISTORY: Dipix is a Canadian owned company incorporated in Canada in September of 1978. They are presently represented on a world-wide basis by various companies. Their US representative is Altek Corp located at 2150 Industrial Parkway, Silver Spring, MD, 20904 - telephone (301) 622-3907.

CAPABILITY: Dipix Systems Ltd has an established capability in the field of digital image processing for remote sensing and digital terrain mapping applications. The company has developed a powerful family of image analysis systems capable of processing imagery from satellite data (e.g., Landsat), digitized imagery (e.g., Photographic), and cartographic (Map Digitizer) sources. Dipix engineers, analysts and programmers have designed many unique features into its systems. As a result, the company has been able to establish and maintain a leading market position with export sales around the world.

Central to Dipix's highly regarded position in the image processing field, is its extensive technical and analytical experience in developing applications and utility software to address user operational needs. Dipix has an enviable in-house research and development track record. The ARIES-II Digital Image Analysis System was developed from scratch over a two year period.

AVERAGE WORK FORCE:

PhDs	- 3
Masters	- 4
Bachelors	- 20
Others	- 28

GROSS SALES: FY 81 - \$3.4M (\$1.6M current backlog)
FY 82 - \$5.2M (projected)

PLANT SIZE: 7,000 sq ft (currently 2 Buildings)
15,000 sq ft (new facility - Nov 82 - 15,000 sq ft expandable to 30,000 sq ft)

EQUIPMENT: Dipix has a full range of modern test equipment including a VAX-750 DEC computer, as well as a number of Dipix ARIES-II Systems used for program and engineering development.

EXPERIENCE: Dipix personnel have many years of experience in digital image analysis going back to the early 1970s. The six original founders of the company were involved in the design and building of the ground station in Italy, as well as the original Aries image analysis system for the Canadian Forestry Service. Dipix has had a close relationship with the Canada Center for Remote Sensing, where they have been contracted for both hardware and software development. At present, Dipix has in excess of thirty turnkey digital image analysis systems installed world-wide. The largest of these systems are in Indonesia, Holland, and Canada.

KEYWORDS: 7=Electronics; 10=Image Processing & Optics; 17=Software Service;
18=Space Systems; Digital Image Analysis=7, 10, 18; Turnkey Systems=7, 10, 18;
Software Development=17; Hardware Development=7, 10, 18;
Transmission of Digital Imagery=7, 10, 18; Storage of Digital Imagery=7, 10,
18; Image Processing=7, 10, 18.

REVISED: Sep 82.

COMPANY: DMR and ASSOCIATES

CODE: DMR

ADDRESS: 112 Kent St, Suite #2218
Ottawa, Ontario, Canada K1P 5P2

CONTACT: Mr. Neil Mustard, Senior Consultant - (613) 238-2697

HISTORY: DMR is a Canadian owned company incorporated in 1973 with offices in Vancouver, Edmonton, Calgary, Toronto, Ottawa, Montreal, Quebec City, St John, and Halifax, as well as international offices in the US, Australia and Singapore. The US office is located in Boston with a Project Office in Los Angeles.

CAPABILITY: DMR provides consulting services exclusively in the field of information and data processing systems. They provide a broad range of services which can be placed under three main categories - Management consulting, technical, and project management. Approximately half of the DMR staff are consultants and project managers who provide advice and direction to client management. The remaining staff is comprised of experienced technical personnel, including computer software specialists, analysts, and analyst-programmers. They promote the use of structured methodologies and strong project control in all activities. A cross section of the services provided is as follows:

Management Consulting - organization planning, requirements analysis, feasibility studies, and executive education.

Technical Services - hardware/software evaluation, selection, and acquisition; data base systems; data communications systems; and data acquisition systems.

Project Management - Systems evaluation, analysis and design; development and implementation of computer systems; and office automation.

A unique feature of DMR and its employees is that they maintain full independence from all hardware, software and computer service suppliers. This gives the consulting staff the freedom they require to act on behalf, and in the best interests of the client, particularly in regard to the evaluation and selection of products and services.

AVERAGE WORK FORCE: Professionals - 500
support Staff - 80

GROSS SALES: 1979/80 - \$12M
1980/81 - \$18M
1981/82 - \$27M

PLANT SIZE: 60,000 sq ft (Office Space across Country)

EXPERIENCE: During the past eight years over one thousand contracts involving over six hundred clients have been successfully completed by DMR for both private industry and government. Contracts included:

Canadian Department of Transport: Designed/programmed various aspects of the Gander Automated Air Traffic System (GAATS-2); performed major

programming enhancements to the National Flight Data Processing Systems (NFDPS) for various aspects of Air Traffic Control; and analyzed communications interface requirements between Flight Display Systems (FDS-COM) and Joint Enroute Terminals System (JETS).

Canadian Department of National Defense: Performed feasibility studies in the areas of - (1) Computer based telemetry system for CF-18 Weapons Clearance Program at Cold Lake, Alberta; (2) Replacement of radar driven plot boards and cameras by graphics display packages; (3) Hardware and software modification requirements to update radar tracking and telemetry recording system at Cold Lake; and (4) Hardware and software requirements to make the New Brunswick Optical Satellite Tracking System Operational. Implemented systems in the following areas - Cold Lake radar simulation program, and modifications to the Cold Lake radar tracking and telemetry recording system software; and real time data acquisition, display and control systems for New Brunswick Optical Satellite Tracking System.

KEYWORDS: 1=Aircraft; 5=Communications; 6=Computers; 7=Electronics; 15=Radar; 17=Software Services; 18=Space Systems; Consulting=5, 6, 7, 15, 17, 18; Studies=5, 6, 7, 15, 17, 18; Systems=5, 6, 7, 15, 17; Data Acquisition=17; Data Processing=17; Air Traffic Control=1, 17; Radar Simulation=15, 17; Radar=15, 17; Measurement & Control Systems=7; Ground Stations=17, 18.

REVISED: Nov 82.

COMPANY: DOCUMENTED CIRCUITS Inc

CODE: DCI

ADDRESS: P. O. Box 8, Station "A"
Kingston, Ontario, Canada K7M 6P9

CONTACT: Mr. David Sprigings, Marketing VP - (613) 389-1032

HISTORY: DCI was incorporated in June 1980 and was fully operational during January 1981. The company is Canadian owned and operates from the design and manufacturing facility located in Kingston. Sales representatives are presently located in Toronto, Montreal, Ottawa, Buffalo, NY, and Norwood, MA.

CAPABILITY: The combination of sophisticated software, state-of-the-art hardware and experienced personnel enable DCI to provide reduced turnaround times, accurate phototools and complete compatible documentation packages at competitive prices. DCI provides a total service to industry including:

- . Printed circuit design utilizing a powerful interactive CAD system.
- . The color coded layout method of printed circuit board design.
- . Digitizing and photoplotting from customer supplied color coded layouts.
- . Photoplotting output tapes from customers CAD systems.
- . Mechanical design services.
- . PCB design consultation services.
- . Assembly drawings.
- . Component lists.
- . Auto insertion reports.
- . Test fixture reports.
- . N/C drill tapes in Excellon, Trudrill and Digital formats.
- . Precision phototooling for component and solder sides, silk screen, solder resist and drill graphic plots.
- . Magnetic tapes to drive the multiwire process.
- . Fast turnaround single, double sided and multilayer printed circuit boards.

DCI has the capability to work to MIL, IEEE, JIC, IPC, and ANSI standards and specifications or to customer defined parameters.

AVERAGE WORK FORCE: Design technicians, training and applications personnel, software development and support engineers, plus an experienced management team for a total staff of 31.

GROSS SALES: 1981 - \$.8M
1982 - \$1.3M (forecast)

PLANT SIZE: 5,000 sq ft

EQUIPMENT: The following equipment is employed by Documented Circuits Inc:

- . Digital Equipment 2060 Computer with 512K of memory.
- . RP06 Disk Packs.
- . TU77 Magnetic Tape Drive.
- . LA120 Printer Terminal.
- . 1055 Calcomp Pen Plotter.
- . Digital Equipment: LP20 Line Printer.
- . (4) Digital Equipment VT100 Terminals.
- . (10) Tektronix 4014 Graphic Terminals.
- . (2) 8602 Talos Digitizing Tables.
- . (2) Gerber Scientific PC-800 Digitizing Systems.
- . 732B Gerber Scientific Photoplotter with a 48"x60" bed.
- . Gerber Scientific 4300 Controller.

Phototools are produced, inspected and packaged in a controlled environment.

EXPERIENCE: DCI has processed designs for companies in the telecommunications, computer, medical, aerospace, and commercial electronics fields. Some of the major accounts include - Rockwell International, Northern Telecom Ltd, Spar Aerospace, and AES Data.

KEYWORDS: 17=Software Services; PC Board Design=17; Consultation Services=17;
PC Board Fabrication=17.

REVISED: June 82.

COMPANY: EBCO INDUSTRIES

CODE: EBC

ADDRESS: P. O. Box 9420
7851 Alderbridge Way
Richmond, British Columbia, Canada V6X 2A4

CONTACT: Mr. Helmut Eppich, President - (604) 278-5578

HISTORY: Ebco Industries Ltd is a Canadian owned company formed in 1956 as a small tool and die shop in Vancouver. The company has had a compounded growth rate of 50% per year since that date and now it is a multi-million dollar concern comprising twenty companies. This highly diversified organization, including all subsidiaries and affiliates, has a wide range of expertise that includes all aspects of machining & fabricating, electro-plating, electronic data entry & processing equipment, electronic R&D, data processing, furniture, general & specialty construction, custom wheels & automotive accessories, real estate, upholstery, and stoves. This profile will concentrate only on their machining capability which can vary from a 20 minute grinding or polishing job to an 18 month multi-million dollar custom 50 ft dia atomic cyclotron.

CAPABILITY: Ebco Industries is a multi-faceted corporation with a major investment in the machining and fabrication business. Their skills and facilities include:

- . Machining of all kinds - milling, grinding, planing, turning, boring, sawing, etc. They also have CNC capability (planer mills and machining center).
- . Fabrication and medium and heavy plate work.
- . Welding - manual, semi-automatic and automatic in steel, stainless steel, aluminum, T-1, nickel-chrome, titanium, copper, low-temperature steel, etc.
- . Thermal stress relieving and heat treating.
- . Sand blasting and painting.
- . Tool and die work, engraving in metals and plastics.
- . Mechanical and hydraulic assembly.
- . Metal stamping.
- . Tube bending and welding.
- . Electro-plating - decorative chrome, brass, copper, zinc, bronze. Industrial hard chrome, cadmium, zinc, iron-manganese and zinc phosphating.
- . Galvanizing plant - hot dip galvanizing. Centrifugal system for small hardware.

Ebco specializes in close tolerance machining utilizing Brunson optical transit squares and 3-axis digital readouts. Their quality assurance procedures meet CSA standards Z299.2, Z299.3, Z299.4, and ASME Section VIII. Their fabrication facility has the capability to shear, cut, burn, bend, shape and roll plate.

Ebco custom builds large and small assemblies, and machines and boasts the largest repair capability in Western Canada. This latter capability is especially applied to the repair and rebuilding of sawmill and pulpmill machinery, and mining equipment.

Ebco is developing a new Aerospace Division that will contain the largest and most sophisticated machining capability available. The main machines comprise two bed tables, each 90 ft long by 160 inches wide, having two gantries per table each with three spindles capable of five axis machining, that operate simultaneously by CNC control. They will also have available anodizing and ultrasonic immersion inspection systems.

AVERAGE WORK FORCE: Total - 500

GROSS SALES: Forecast for Year ending Sep 82:

\$19.4M (Ebco Industries Ltd)

\$34.0M (Ebco Industries Ltd plus Subsidiaries)

PLANT SIZE: 211,022 sq ft on 13 Acres (additional 52 acres for future development)

EQUIPMENT: Facilities: Crane capacity - maximum lift 150 tons, 40 ft under hook (in shops); maximum lift 70 tons, 36 ft under hook (in yard); Door Size - maximum 24 x 24 ft; and Shipping facilities - road, rail and water loading capacity. Ebco's equipment list is too voluminous to itemize in this profile, however, the following is a brief summary - punch presses ranging from 15 to 250 tons; overhead cranes ranging from 5 to 80 tons; mobile cranes up to 7.5 tons; cutting equipment - Linde 4 & 8 head with tracers, plasma arc machine, ironworker, sheet metal and plate shears; and Stress Relief Furnace 50 ft, 20 ft wide, 16 ft high, maximum temperature 100°C and maximum load 100 tons.

Other equipment includes welding manipulators, boring mills, planers, lathes, milling machines, drills, forming presses, plate rollers, welding equipment, planer mills, CNC machines with software preparation and programming system, and various inspection and quality control equipment.

EXPERIENCE: Ebco's clients include - Boeing Co (MX transporter trailer for USAF and CNC - machined components for jetfoil vessel for USN), Hooker Chemical Co (Electrolytic cathode cells for Chlorine plants), DeHavilland Aircraft (CNC - machined aluminum components for Dash 7 and Dash 8 aircraft), University of British Columbia (56 ft vacuum tank and resonators for the Meson Facility - TRIUMF Project), Robbins Co (underground tunnel boring machines to 32 ft dia), Lockheed Petroleum Services Ltd (wellhead cellars for sub-sea oil well drilling and exploration), plus many other companies and a variety of manufactured items.

KEYWORDS: 12=Machining; Extended Length Machining=12; Metalworking=12;
Heat Treating=12; Coating Specialized=12; Precision Machining=12; Stamping=12;
Tooling Fabrication=12; Die Fabrication=12; Titanium=12;
Mechanical Assembly=12; Hydraulic Assembly=12; Repair Capability=12.

REVISED: Oct 82

COMPANY: ENCHEM DEVELOPMENT CO

CODE: ENC

ADDRESS: 509 - 2024 Fullerton Avenue
North Vancouver, BC, Canada V7P 3G4

CONTACT: Dr Gerald B Porter, President -(604) 922-3844

HISTORY: The company is a sole proprietorship (individual) established in Nov 80 for scientific research and development in chemical energy and related fields of chemistry.

CAPABILITY: The company's expertise resides in Dr Porter. Until his resignation in Aug 81, Dr Porter was a Full Professor of Chemistry at the University of British Columbia. His basic research program in photochemistry there during the past 25 years has resulted in over 60 scientific publications. This work will be continued on a part-time basis, funded by the Natural Science and Engineering Council of Canada.

Laboratory facilities are rented from Simon Fraser University in the greater Vancouver area. Research and development will be undertaken in applications of photochemistry, in conversion of chemicals to other forms of energy and vice versa.

AVERAGE WORK FORCE: Professionals - 1

GROSS SALES: Not available. The company has only been active since Dr Porter's resignation from UBC. Anticipated income for 1982 is \$60,000.

EQUIPMENT: All laboratory equipment of the Department of Chemistry at Simon Fraser University is available to Enchem. This includes mass spectrometers, NMR, visible-uv spectrometers. Analytical services by Canadian Microanalytical and equipment construction by Sciema Technical Services, both in the Vancouver area.

EXPERIENCE: The company has a current contract with the Canadian Federal Government for solar energy developmental work. Dr Porter's experience is in inorganic photochemistry and photophysics, spectroscopy and kinetics, using lasers of various types and highly sensitive detection systems. He is a cooperative user of a picosecond laser facility in Montreal at Concordia University.

KEYWORDS: 4=Chemistry; 8=Energy; 11=Lasers; 20=Miscellaneous; Inorganic=4; Photochemistry=4, 8, 11; Photophysics=8, 11; Energy Conversion=8; Thermodynamics=4; Studies=4, 8, 20; Research=4, 8, 20; Spectroscopy=4, 8, 11, 20; Kinetics=4, 11.

REVISED: Feb 82.

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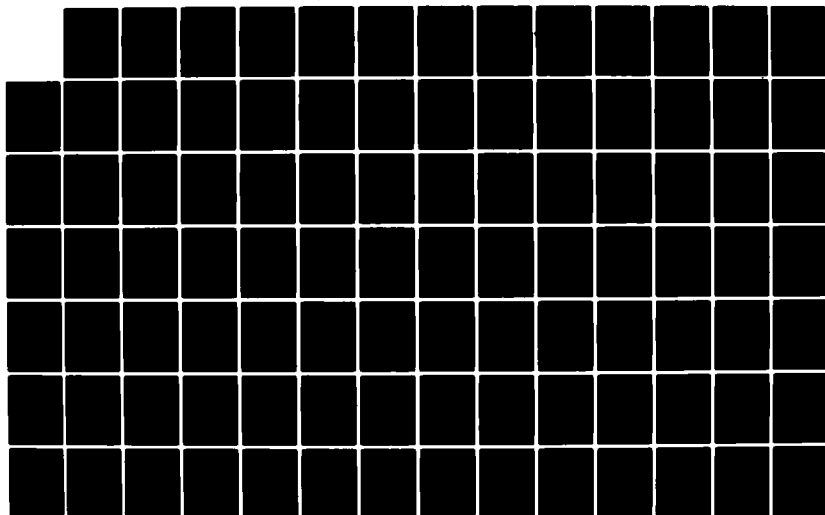
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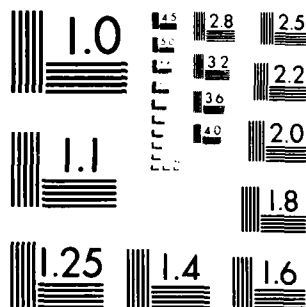
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MICROCOPY RESOLUTION TEST CHART
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COMPANY: ENVIRONMENTAL APPLICATIONS GROUP Ltd

CODE: EAG

ADDRESS: 114 Avenue Road
Toronto, Ontario, Canada M5R 2H4

CONTACT: Dr. Tom B Low, Chief Physical Scientist - (416) 968-3684

HISTORY: The Environmental Applications Gp Ltd was incorporated in 1977 to provide multidisciplinary environmental services to industry and government. It is entirely Canadian owned by four principals, with its sole office in Toronto.

CAPABILITY: The company was formed as a consulting firm with two major divisions - Atmospheric, and Life Sciences. The Atmospheric Division engages in R&D in pure and applied meteorology, climatology, cloud physics, air quality, and air-sea interaction. Scientific expertise includes numerical modelling of atmospheric phenomena, experimental design and field studies, instrumentation, data analyses, and environmental assessment.

AVERAGE WORK FORCE:

PhDs	- 3
MSs	- 3
BSS	- 3
Others	- 4

GROSS SALES:

1978	- \$0.25M
1979	- \$0.32M
1980	- \$0.45M
1981	- \$0.70M
1982	- \$0.50M

PLANT SIZE: 3,250 sq ft (Office Space)
750 sq ft (Laboratory/Workshop)

EQUIPMENT: Special equipment and facilities include the following:

- . Atmospheric - tetheredsonde (Altitude to 1 Km) and airsonde (Altitude to 25 Km) systems utilizing radiotelemetry and optical theodolites for boundary layer and upper air measurements, and remote meteorological base station.
- . Air Quality - high-volume particulate samplers, and SO₂ gas analyzers.
- . Remote Field Facilities - winterized trailer, tents, snowmobiles, and electrical generator for a long term remote field camp capable of Arctic operations.
- . Laboratory - equipped for physical, chemical, microbial, and biological analyses; and includes an atomic absorption spectrophotometer.
- . Data Processing - includes a in-house Wang 2200 VP mini computer with access via timesharing to DEC, IBM, and CDC mainframes.

EXPERIENCE: Environmental Applications Gp Ltd has experience with Canadian Environmental Protection Service, Atmospheric Environment Service, Ontario Hydro, Onakawana Development Ltd, Potash Company of America, Oshawa Harbor Commission, Amoco Minerals Ltd, Polar Gas Project and Ontario Ministry of Environment.

Typical Projects of Environmental Applications Gp Ltd include:

- . Toxic Organic Emissions Study
- . Atmospheric Loadings and Emissions Study
- . Upper Atmospheric Experiments
- . National Emissions Inventories - Natural Alkaline Particulate; Organic Compounds; Sulfur, Nitrogen and Mercury Compounds; and Great Lakes Atmospheric Disposition Model.
- . Natural Gas Pipeline Associated Studies
- . Meteorological Studies using Tethered Balleous
- . Air Quality Studies

KEYWORDS: 8=Energy; 9=Environment; Meteorology=9; Micrometeorology=9; Radar Meteorology=9; Satellite Meteorology=9; Climatology=9; Air Quality=9; Pollution Monitoring=9; Environmental Assessment=9; Dispersion Modelling=9; Long Range Transport=9; Boundary Layer=9; Upper Air=9; Cloud Physics=9; Cloud Dynamics=9; Weather Modification=9; Solar Energy=8; Wind Energy=8; Acoustics=9; Icing=9.

REVISED: Jul 82.

COMPANY: EPIC DATA SALES Ltd

CODE: EDS

ADDRESS: 7280 River Rd
Richmond, British Columbia, Canada V6X 1X5

CONTACT: Mr. Norman A Cafik, General Manger - (604) 273-9146

HISTORY: Epic Data Sales Ltd is a member of the Ebco group of companies (See Ebco Industries Ltd). They are a Canadian owned company incorporated in mid-1974. The large diversification of capability and products associated with Ebco Industries caused many problems in labor and material tracking. They looked for an automated system that would solve these problems and discovered there was no system available that would perform these functions at a reasonable price. They developed their own data collection system and Epic Data Sales Ltd was formed.

CAPABILITY: Epic Data Sales Ltd develops and manufactures data collection systems based on microprocessor technology. Their terminals and controllers are designed using solid state components. This enables them to keep down cost while maintaining reliability. The user terminals on the factory floor, the office, or other environments are simple and straight-forward to use.

Each Multi-Function Terminal (MFT) model may be upgraded to provide new input devices (e.g., magnetic stripe reader), special interfaces (e.g., weight scale), or peripherals (e.g., CRTs or printers). In almost every case, adding capabilities to a system does not obsolete equipment already purchased. In addition to their MFT terminals, they have developed Single Function Terminals (SFT) and Environmentally Sealed Portable Terminals (ESPT). Their first SFTs collect data solely via a barcode wand. They are planning a single function barcode slot reader and a single function magnetic stripe reader terminal. The ESPT is a battery operated data collection terminal that can be used in hostile, harsh, remote environments where any other method of data collection is impractical. Epic's controller, the System Control Unit (SCU), controls terminal polling, sequencing, editing, transaction assembly, output to host or off-line storage, and time of day generation. A recent announcement is the capability to program the controller's sequencing, prompting and editing functions at the host computer, and down-line loading the new program to SCU. Epic is also developing a system control unit that will be able to perform validation via table lookups from a Winchester disk, a mini/micro computer and turnkey software package (e.g., time and attendance, job costing, and library application programs).

Epic's field of expertise lies in adapting microprocessor technology, both hardware and software, to the broad context of data collection. Specifically, engineering provides support to customers of standard products and in addition, have experience in project management of custom designs.

The capabilities of the assembly group include - PCB component insertion, wave soldering and board cleaning, terminal assembly, cable fabrication, and metallized foil label making. The Manufacturing Test Group performs board and terminal burn-in and test. Self Test Program (STP) prompts are utilized during the terminal burn-in process to check out and monitor terminal functions. Customer orders are fully configured in-house and go through a full systems test prior to shipping. Multi-stage quality monitoring is provided by an

independent QA/QC/Production Engineering group. This group is also responsible for field installations. Epic Data's manufacturing facility is augmented by it's parent company, Ebco Industries Ltd. Ebco provides capabilities in the areas of metal fabrication, painting, and tool & die making.

AVERAGE WORK FORCE: Total - 70

GROSS SALES: 1980 - \$3.9M
1981 - \$1.8M
1982 - \$3.5M (as of September 82)

PLANT SIZE: 14,500 sq ft

EQUIPMENT: Epic Data's equipment list include - Wave solder machine (Aqueous Flux); Aqueous PCB Washer and Contaminant Monitor; PCB dry and bake chamber; component prep machines; semi-automatic IC inserter; metalized foil processing equipment; automatic shorts checker; cable tester; power supply tester; PCB burn-in rack; walk-in terminal burn-in room; drill presses; flat cable press; crimp terminal machines; and miscellaneous meters, scopes, and debugging aids.

EXPERIENCE: Epic Data is touted to be a world leader in the manufacture and design of data collection equipment. They have major clients throughout the world and their equipment is frequently recommended for use by such major computer companies as Xerox, Tandem, Digital Equipment Corp, and Sperry Univac. Epic Data customers include - General Electric, Monsanto, General Motors, Motorola, Mexican Government, FX Leipold (West Germany), Plessey France S.A. (France), City and County of San Francisco, Canadian Government, and others.

KEYWORDS: 6=Computers; 7=Electronics; 17=Software Services;
19=Testing/Test Equipment; Solid State Devices=7; Design to Requirements=17;
Data Collection Systems=7; Terminals=7; Portable Terminals=7; Controllers=7;
System Controllers=7; Microprocessor Technology=6, 7; PC Boards=7;
Component/System Testing= 7, 19.

REVISED: Sep 82.

COMPANY: EPITEK ELECTRONICS Ltd

CODE: EEL

ADDRESS: 100 Schneider Road
Kanata, Ontario, Canada K2K 1Y2

CONTACT: Mr. Lee Lockwood, Export Sales - (613) 592-2240

HISTORY: Epitek Electronics was incorporated in 1969 with a US subsidiary, Epitek Electronics Inc, located in Odgensburg, NY. The latter is a distribution center only. The company specializes in the design, development and production of thick film hybrid circuits and networks for the electronics industry. Epitek Electronics is a division of Epitek international Inc.

CAPABILITY: The Epitek custom design expertise is directed primarily towards the following market areas - (1) Computer Communications (terminator networks, modem hybrids, tone squelch hybrids); (2) Telecommunication: (line matching networks, RF hybrids); (3) Instrumentation (ladder networks, input alternators, voltage dividers); and (4) Military Devices (oscillator hybrids, trimmable resistor networks, Codec hybrids). Their standard product line includes audio amplifiers, active filters, telephony hybrids, and SIP/DIP resistor and resistor-capacitor networks. Epitek strives for quality control and can design to meet MIL-M-38510, MIL-STD-883 and MIL-R-83401. They are now beginning to carry out R&D in the thin film area and intend to develop expertise in solar cell and chip resistor line technology in the near future. Approximately 5% of their budget is directed towards internal R&D. The company has a facility security clearance.

AVERAGE WORK FORCE: PhDs - 4
 Engineers - 5
 Others - 200

GROSS SALES: \$6.5M (Current)

PLANT SIZE: 32,000 sq ft

EQUIPMENT: Epitek's manufacturing facility is equipped with all the standard production and test equipment to insure quality production. Special equipment includes two YAG laser trimmers and CO2 ceramic laser scribe.

EXPERIENCE: Epitek's sales are divided - 60% to the US and 40% to Canada. They have no direct sales to the US military, but about \$3M to the DOD through US primes. The indirect DOD sales are in the areas of mines and sonobouys. Epitek is interested in doing business with the USAF.

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics;
Solid State Devices=5, 6, 7; Custom Circuits=5, 6, 7; Microcircuits=5, 6, 7;
Hybrid Circuits=5, 6, 7; Instrumentation=7; Telecommunications=5, 7;
Sonobouy Components=7; Mine Components=7; PC Board Design & Fabrication=5, 6, 7; Thick Film Hybrid=5, 6, 7; Thin Film Hybrid=5, 6, 7.

REVISED: Nov 82.

COMPANY: EXCO ENGINEERING

CODE: EXC

ADDRESS: 220 Torbay Road
Markham, Ontario, Canada L3R 2P3

CONTACT: Mr. Brian Robbins, President- (416) 475-9440

HISTORY: Exco Engineering is a division of Extrusion Machine Co Ltd, a private, wholly owned Canadian company incorporated in 1951. Exco was formed in 1970 as the result of a company reorganization and operates as a custom machining and engineering division.

CAPABILITY: Exco Engineering is a custom machining and engineering facility that is equipped to work to MIL-I-45208A, DND-1016 and CSA-Z-299-3. The company specializes in the design of special machines, die cast tooling, and extrusion tooling. It can supply aircraft components, precision machine parts, die cast dies, shot sleeves, and extrusion tools (dies, mandrels, mandrel holders, liners, containers and stems). Exco services include NC machine work, Blanchard grinding, EDM machining, 3-D copy milling, general machining and particularly large CNC machining.

AVERAGE WORK FORCE: Machinist/Toolmakers - 100
Eng/Admin - 20

GROSS SALES: 1980 - \$ 6.0M
1981 - \$ 7.5M
1982 - \$10.0M

PLANT SIZE: Markham Plant - 26,000 sq ft x 22 ft
Markham Plant - 10,000 sq ft x 24 ft, 6 in
Scarborough Plant - 14,000 sq ft x 5 ft
New Expansion - 12,000 sq ft high bay

EQUIPMENT: Exco's new expansion is equipped with 2 bridge cranes, 2 double hook of 30-ton and 10-ton capacity, and another single hook of 10-ton capacity. It is also equipped with four 5-inch spindle CNC horizontal Boring Mills and two CNC Vertical Boring Mills. Their Scarborough plant concentrates exclusively on aluminum extrusion dies. The Markham plants are equipped with those items typical of an Industrial Service Center, e.g., various types of cranes, mills, lathes, CNC equipment, electrical discharge machinery, grinding machinery, honing machinery, cutting equipment and various other equipment.

Exco is currently embarking on the acquisition of a sophisticated CAD/CAM System (ComputerVision Designer V Interactive Graphics System) tied in with a motorized coordinate measuring machine (Bendix Cordax Coordinate Measuring Machine). This equipment will enhance their design and inspection capability and also improve their NC programming. The Bendix Cordax Coordinate Measuring Machine will be fully compatible with existing equipment, and above all, close the loop in an overall computer design, manufacturing and inspection system. It will give Exco the unique capacity to accept, direct from customers, geometric data of part description.

EXPERIENCE: Exco has supplied components and parts to such organizations as deHavilland Aircraft, McDonnell-Douglas, Canadair and Sperry Gyroscope.

KEYWORDS: 1=Aircraft; 12=Machining; Precision Machining=12;
Machine Design=12; Tooling=12; Extrusion Tooling=12; Heat Treating=12;
Component Parts=1; Die Fabrication=12.

REVISED: Aug 82.

COMPANY: EXPLOSAFE DIVISION OF VULCAN INDUSTRIAL PACKAGING Ltd CODE: EXP

ADDRESS: 414 Attwell Drive
Rexdale, Ontario, Canada M9W 5C3

CONTACT: Mr. Richard C Turner, President & General Manager - (416) 675-6492

HISTORY: Vulcan was incorporated in 1961 in Canada as a publicly owned company. It is the parent company, having seventeen operating Divisions across Canada, and is the leading packaging/container Corporation in Canada.

The Explosafe Division was formed in 1973 to separately handle the design, research & development, manufacture, and sale of the "Explosafe" Engineered Explosion Prevention System. Under the guidance of the engineering and technical staff of this Division, the "Explosafe" system underwent all the development, qualification testing, and evaluation cycles attendant to obtaining the USAF Wright Patterson Laboratory product approval documented in Report #AFWAL-TR-80-2043, and subsequently supported by specification MIL-B-87162 (USAF) with vendor sourcing as identified in Qualified Products Listing QPL 87162-1 issued in Apr 82.

CAPABILITY: "Explosafe" is a practical method of preventing containers of volatile liquids and gases (i.e., gasoline, naphtha, diesel, liquid petroleum gas (LPG), benzene) from explosion resulting from electrostatic discharge, fire bombing, gunfire, or post crash ignition, etc. The "Explosafe" system is based on a matrix of aluminum foil, slit and expanded to form a mesh of hexagonal openings. When layered, the mesh results in an open-cell batt, cut and shaped into modules for incorporation into any sized container. By installing "Explosafe", the container's interior is transformed into a honeycomb of small cells or compartments. In the event of ignition, the "Explosafe" system acts as a heat dissipator, modifies flame propagation, and prevents explosion. Explosafe salient features include:

- . Displaces maximum one-percent of fuel capacity for any given volume.
- . System is passive therefore offers permanent life time installation capability - low life cycle cost.
- . Dissipates static electricity.
- . Does not sustain fire and does not emit toxic fumes.
- . Designed in modular form, facilitates retrofit in old or new fuel tank installations.
- . Provides radical reduction of fuel slosh and facilitates elimination of fuel baffles.
- . Facilitates reduction of tank stress and failure.

AVERAGE WORK FORCE: Division - 35
Corporate - 850

GROSS SALES: 1981 - \$38.5M

PLANT SIZE: Division - 30,000 sq ft
Corporate - 1.5M sq ft

EQUIPMENT: Explosafe Division's modern facility is equipped with machinery of proprietary design to slit, expand, fanfold, stitch, and shape modular kits of "Explosafe" for all fuel tank shapes and sizes.

EXPERIENCE: Through the past five years, the Explosafe Division participated with the Canadian Government/USAF evaluation of the aircraft fuel tank ullage explosion prevention system of "Explosafe". This effort has resulted in test/evaluation completion as documented in report #AFWAL-TR-80-2043. This subsequently substantiated by US Government specification MIL-B-87162 and borne out by Qualified Products Listing QPL-87162-1.

Through prototype and production contracts, Explosafe has been included in the following vehicles - FMC - M113, LVTP-7A1; Cadillac Gage - "Peacekeeper"; Bombardier - Canadian Armed Forces two and one half ton military vehicle; Navy Sea Fox; and numerous others.

KEYWORDS: 1=Aircraft; 14=Protective Equipment; 16=Security & Safety; 20=Miscellaneous; Explosion Suppression Systems=1, 14, 16, 20; Explosafe=1, 14, 16, 20.

REVISED: Oct 82.

COMPANY: EXPRO CHEMICAL PRODUCTS Inc

CODE: ECP

ADDRESS: P. O. Box 5520
Valleyfield, Quebec, Canada J6S 4V9

CONTACT: Mr. R D Heddle, Director of Marketing - (514) 371-5520

HISTORY: Expro Chemical Products Inc (formerly Valleyfield Chemical Products Corp) was started in 1940 and has been operating continuously ever since. The complex has undergone two multi-million dollar modernization programs - the first in 1950-1952 and the second in 1977-1978. It was incorporated under the former name in 1977. The company changed ownership on 15 March 1982. Because of the new minority share interest held by CIL Inc, the company will have access to Nobel's Explosive Company, Ardeer, Scotland. The latter company has extensive capability for primary research.

CAPABILITY: Expro is a fully integrated commercial and military propellant and explosives complex. It has its own capability to produce nitric acid, nitroglycerine, nitrocellulose, propellants, and RDX. Nitrocellulose is produced by the batch process, utilizing wood pulp of high alpha cellulose content and nitric acid produced at the plant. It also has the capability to produce nitrocellulose from cotton linters. Present plant capacity for nitrocellulose production is 12 million pounds per year, with the capability to expand to 40 million pounds annually should the need arise.

Expro uses the in-house produced nitrocellulose in the manufacture of single-base, double-base and triple-base propellants. The former are primarily used in small arms munitions, military or sporting, in medium caliber military ammunition, and large caliber weapons in multi-perforated form. The double-base product is used mainly for small caliber guns. The plant produces its own nitroglycerine, using the Biazzi Process, for the manufacture of the double and triple base propellants. Nitroguanidine for triple-base propellant manufacture is purchased.

Expro produces RDX by the Bachmann Process. It is manufactured to military specifications in various granulations as required. The RDX is mixed with TNT to produce cyclotol. Other products include Composition B, Compositions A-3 & A-4, and Compositions C-4 & A-5. Demolition Block M5-A1 and M112 is also manufactured at the company's facilities.

AVERAGE WORK FORCE: Total - 650

GROSS SALES: No Data

PLANT SIZE: 1,800 acre site

EXPERIENCE: Though its prime client continues to be the Canadian Department of National Defense, Expro is one of the two accredited suppliers of propellant for the US Air Force GAU-8/A weapon system. With respect to the GAU-8 system, they supply Honeywell with both propellant and high explosive (Comp A-4) and Aerojet with Comp A-4. Other major clients in the US include Olin Corp (Nitrocellulose for ball propellant), and E. I. DuPont de Nemours (propellant). Their US distribution for HE is Goex. Expro has received orders for its propellants and explosives from the Netherlands, Belgium, Portugal, Italy, France, Greece and Turkey.

KEYWORDS: 2=Armament; 4=Chemistry; 20=Miscellaneous; High Explosives=4, 20;
Ingredients=2, 4, 20; Propellants=4, 20; High Energy=2, 4, 20;
Nitrocellulose=4, 20; Manufacture=20; RDX=4, 20; Single Base=4, 20;
Double Base=4, 20; Triple Base=4, 20; Composition B=4, 20; (A-3)=4, 20;
(A-4)=4, 20; (A-5)=4, 20; (C-4)=4, 20; Demolition Block=4, 20.

REVISED: Jun 82.

COMPANY: FAG BEARING Ltd

CODE: FAG

ADDRESS: 801 Ontario St
Stratford, Ontario, Canada N5A 6T2

CONTACT: John Tsaltas, Customer Service - (519) 271-3230

HISTORY: FAG Bearing Ltd has been in business since 1883 (Germany). The company is incorporated under the laws of the Dominion of Canada. Branch offices are located in Vancouver, Calgary, Edmonton, Winnipeg, Saskatoon, Sudbury, Toronto, Hamilton, Quebec City, Montreal, and Truro. A US affiliate, FAG Bearing Corp, is located in Stamford, Conn.

CAPABILITY: FAG Bearing Ltd is involved in the manufacturing of precision ground anti-friction bearings - including instrument & miniature bearings, waterpump shaft assemblies, and separate aircraft bearing assemblies.

<u>AVERAGE WORK FORCE:</u>	Engineering	- 14
	Production	- 415
	Admin & others (Stratford)	- 151
	Total	- 580

GROSS SALES: No Data

<u>PLANT SIZE:</u>	Manufacturing	- 200,000 sq ft
	Warehouse	- 75,000 sq ft
	Engineering	- 4,000 sq ft
	Laboratory	- 2,500 sq ft

EQUIPMENT: FAG Bearings has complete facilities to manufacture precision ground anti-friction bearings from raw materials (bar stock or tubing). Tolerances to ABEC 9. Aircraft bearing production started in 1981 (heat treating, grinding, assembly, etc). They have well equipped heat treating facilities, a metallurgical laboratory, bearing testing facilities (life, noise, torque, etc.), complete clean room (Class IV), assembly for instrument bearings, and separate aircraft assembly. FAG Bearings also has:

- . Material Control Laboratory - Microscope (mag 1250x) Leitz; Vickers Micro Hardness Tester; Rockwell Hardness Tester; and Eddy Current and Ultrasonic Devices.
- . Heat Treating Furnaces - Vacuum (computer controlled), Batch with Endo Thermic Generators, Continuous type (Nitrogen/Methane), Induction, Salt, and Carburizers (pack & gas).
- . Deep Freeze.
- . Mass Spectrometer - Leak Detector.
- . Infrared Analyzers.

EXPERIENCE: FAG Bearing has experience with many US and Canadian companies - Garrett (Airesearch) in Phoenix, AR; Bendix Corp at various locations; GE in Wilmington, MA; Litton Industries at various locations; McDonnell Douglas in

Grand Rapids, MI; Sperry at various locations; Varian Assoc in Beverly, MA; Canadian Marconi in Montreal, Que; Spar Aerospace in Toronto, Ont; Canadian Commercial Corp in Ottawa, Ont; DISC Defense Ind Supply Center in Philadelphia, PA; Dept of National Defense in Downsview, Ont; and US Army Aviation in Texarkana, TX. Final destinations of some contracts include numerous US Air Force Bases.

KEYWORDS: 1=Aircraft; 12=Machining; 20=Miscellaneous; Bearings=1, 12, 20; Precision Bearings=1, 12, 20; Anti-Friction Bearings=1, 12, 20; Waterpump Shaft Assemblies=12, 20; Instrument Bearings=12, 20; Miniature Bearings=12, 20.

REVISED: Sep 82.

COMPANY: FITTINGS (1980) Inc

CODE: FIT

ADDRESS: 135 Bruce St
Oshawa, Ontario, Canada L1H 1R1

CONTACT: Mr. T A Santos, President - (416) 723-3433

HISTORY: Fittings Ltd was formed in 1901 to provide a variety of quality castings. The company changed its name to Fittings (1980) Inc to reflect a change in management.

CAPABILITY: The company furnishes complete support for total casting projects from functional concept to designing, material selection, and final finishing. Providing both malleable and pearlitic iron castings, from ounces to pounds, their main production runs are for castings from 1 to 10 pounds. Working to ATSM standards and using a tool and gauge calibration system traceable to the National Bureau of Standards, they emphasize complete quality control procedures for all phases of their operation. They have the capability to coin Victaulic-style iron fittings for pipe-ends to +.010, thus eliminating the formerly used expensive machining processes.

AVERAGE WORK FORCE:

Production	- 211
Engineering	- 2
Quality Control	- 10

GROSS SALES: 1980 - \$10M
1981 - No Data

PLANT SIZE: 200,000 sq ft (165,000 sq ft devoted to manufacturing)

EQUIPMENT: Molding equipment - 8 automated matchplate machines, 3 turntables, and 3 roto-lift machines with conveyor lines; Sand facilities - 3 automatic batch sand mixers and automatic moisture control; Melting facilities - 3 coreless induction furnaces with 13.5 ton capacity each; Annealing facilities - 3 continuous, 30-hour cycle protective atmosphere ovens; and Space straightening facilities - 5, 300 & 500 ton hydraulic presses.

EXPERIENCE: Fittings (1980) Inc has had wide experience dealing with US firms which include - Rockwell International, Massey-Ferguson, Chrysler, Dresser Industries, Cast Metal Industries, and others.

KEYWORDS: 12=Machining; Precision Casting=12.

REVISED: Jul 82.

COMPANY: FLEET INDUSTRIES
(A Division of Ronyx Corporation Ltd)

CODE: FLT

ADDRESS: P. O. Box 400
Fort Erie, Ontario, Canada L2A 5N3

CONTACT: Mr. H F MacRitchie, Sales Manager - (416) 366-4435

HISTORY: Fleet Industries began operations in Canada in 1930 as Fleet Aircraft of Canada Ltd. Ronyx Corp Ltd, Hughson Street South, P. O. Box 800, Hamilton, Ontario L8N 3M8, has two divisions - Fleet Industries (manufacturing), and Ronark Developments (real estate division).

CAPABILITY: Fleet Industries manufactures major components for the prime Canadian and US manufacturers of commercial and military aircraft; helicopters; satellites; and radar and sonar systems. Fleet was established in Canada in 1930 to design and manufacture aircraft for the world's civilian, transport, and military markets. Between 1930-1950, almost 4,000 complete aircraft were built at Fleet and flown from the company's 2,400-ft on-property runway.

Today the company concentrates its efforts on the production of major components. Fleet has enclosed facilities of approximately 500,000 sq ft, and about 850 employees. Assembly and test methods meet the latest requirements of both civil and military authorities in Canada and the US. Fleet's ability to produce quality products on schedule and at competitive prices has won a high reputation for the company in both commercial and defense work. In 1980, Fleet's sales were more than \$44M including new programs for the Sikorsky Black Hawk helicopter for the production of Medevac kits and blade sub-assemblies. Fleet's products include:

AIRCRAFT:

Boeing - 707 fin and rudder; 727 aft engine fairing; 747 SP wing-to-body fairing structure; Boeing E3A TF33 engine nacelles; and 757 APU doors.

Canadair - Challenger CL600 rudder assembly.

deHavilland - DHC-5 bonded components; DHC-6 bonded components; DHC-7 bonded components and engine nacelles; DHC-7 wing leading edges, ailerons; and DHC-8 bonded wing and fuselage panels.

Grumman - A6 inboard and outboard flaps, and bonded honeycomb assemblies.

Lockheed - L-1011 main landing gear doors (aft dorsal structure & aft engine cowlings), and CP140/P3C flight station.

McDonnell-Douglas - A4E speed brakes and flaps; F18A graphite avionics doors; and DC-9 flaps and ailerons (Canada).

Sikorsky Aircraft - Black Hawk UH60A Medevac kits, and blade sub-assemblies.

RADAR:

General Electric - ASR welded antennas.

Lockheed Electronics - Gun fire control system antennas and cabinets.

Raytheon - Phased array antennas "Pave Paws" & "Cobra Judy".

Sperry - Gun fire control system antenna and cabinet.

SATELLITE:

Hughes Aircraft - Solar panel substrates, Anik C, SBS, NASA, Anik D, GOES/GMS, Westar/Palapa B, Lesasat, and AT&T.

Spar Aerospace - Bonded panels/structures, Anik C, SBS, Anik D, and Westar.

SONAR:

Dept of Supply & Services - Retractable fixed hull mounted, towed bodies, VDS systems and faired tow cables; and repair and overhaul.

EDO Corp - Transducer structure.

General Electric - Heat exchangers.

Westinghouse Canada Ltd - Retractable fixed hull mounted, towed bodies, VDS systems and faired tow cables.

Raytheon - Variable depth sonar (VDS) hoist system.

AVERAGE WORK FORCE: Total - 755

GROSS SALES: 1980 - \$36.6M
1981 - \$47.7M

PLANT SIZE: 500,000 sq ft

EQUIPMENT: Fleet Industries' equipment include Kearney & Trecker, Sundstrand and Cincinnati numerically controlled equipment, autoclaves, mills, lathes, presses, furnaces and other special equipment associated with aerospace manufacturers.

EXPERIENCE: In 1981, from sales of almost \$45M, some 90% was exported to the US. Commercial sales accounted for 53% with 47% military.

Facilities and skills have been developed to produce a diversified list of mechanical structures which include radar, sonar, air cushion vehicles, and other defense and commercial assemblies. In the bonding field, Fleet Industries manufactures a wide range of structural components such as antennas, space satellites, electronic cabinets and other specialized items requiring composite technology.

The list of Fleet's customers reads like a "who's who" of the aerospace industry. Boeing, DeHavilland, General Electric, Grumman, Hughes, Lockheed,

McDonnell Douglas, Raytheon, Sperry, Westinghouse, and many other have placed their confidence in the ability of Fleet Industries to produce quality components.

Fleet Industries' Quality Assurance Program meets the requirements of both Canadian Government specification DND-1015 and US Mil Spec MIL-Q-9858A. The average ratio of inspection to direct labor is 1:10. To insure that production of components meets contractual requirements, the Quality Assurance department reviews and defines product quality with the engineering department; collaborates in the review of specifications; generates quality assurance procedures; reviews quality problems; and effect corrective action and reports on departmental quality performance. Standard mechanical inspection techniques are supplemented by magnaflux, fluorescent penetrant, radiography, destruction testing, chemical analysis, and three-axis co-ordinate measuring equipment.

KEYWORDS: 1=Aircraft; 3=Avionics; 7=Electronics; 15=Radar; 18=Space Systems; 20=Miscellaneous; Components=1; Rudder Assemblies=1; Engine Fairings=1; Doors=1; Engine Nacelles=1; Bonded Components=1, 18; Ailerons=1; Bonded Honeycomb Assemblies=1; Cowlings=1; Speed Brakes=1; Flaps=1; Graphite Avionics Doors=1; Panels=1; Helicopter Blade Subassemblies=1; Medevac Kits=1; Welded Antennas=3, 15; Air Cushion Vehicles=1; Composite Components=1, 7, 15, 18; Cabinets=7; Satellites=18; Antennas=3, 15; Sonar=20; Repair & Overhaul (Sonar)=20; Transducer Structure=20; Heat Exchangers=20; Variable Depth Sonar Systems=20; VDS Hoist Systems=20.

REVISED: Aug 82.

COMPANY: FOUNDATION ELECTRONIC INSTRUMENTS Inc

CODE: FEI

ADDRESS: 1794 Courtwood Crescent
Ottawa, Ontario, Canada K2C 2B5

CONTACT: Mr. Attila J Szanto, President - (613) 226-4000

HISTORY: Foundation Electronic Instruments Inc is a wholly Canadian owned corporation specializing in research, development and manufacturing for the communications industry, primarily in the area of fiber optics. The company began operation in late 1974 and was incorporated in 1977. There are no other divisions of the company in Canada and no US subsidiaries, although a US sales office is planned for late 1982.

CAPABILITY: Foundation Electronic Instruments Inc is a high-technology company that performs design and development of communications equipment and systems. The primary area of expertise is in fiber optic communications equipment and systems. Other areas of expertise and demonstrated capability are in custom design of energy use, monitoring and control instruments, and in industrial process control; including the use of computer or micro-computer technology.

Company capabilities are both varied and wide-ranging because of their extensive research and development background. The company product line reflects this capability and includes - portable microphone mixers for broadcast use; a sub-miniature time-date generator for video systems; military secure voice switchboard; telemetry and data acquisition systems, seismic recording equipment; broadband video switchers (to 100 MHz); and fiber optic communications equipment, systems and components.

The research capabilities with respect to fiber optic systems are best related by referring to systems that have been or are currently being designed by Foundation Electronic Instruments' personnel. These projects include - fiber optic transmission system; 20 MHz baseband analog with broadcast video performance; 100 MB/S digital link; bi-directional low speed (56 KB/S) data links; and special fiber optic system for a shipboard communications simulator. Secure data circuits using fiber optics, subscriber and central office terminals for telephone systems, T1 and T2 rate long haul fiber optic communications, tactical fiber optic communications systems and fiber optic performance measurement instruments, are also products which Foundation Electronic Instruments Inc is designing.

Foundation Electronic Instruments' capabilities are being expanded to include - multi-channel fiber optic communications systems, microprocessor based instrumentation development, clean room facilities, environmental test facility and optical device handling and assembly.

AVERAGE WORK FORCE: Engineers - 22
Production - 10
Admin - 5

GROSS SALES: 1980 - \$1M
1981 - \$2.4M

PLANT SIZE: 8,200 sq ft (22,000 sq ft planned for new facility by late 1982)

EXPERIENCE: Foundation Electronic Instruments Inc has experience with government and commercial corporations, several of which are listed below:

- . Department of National Defense
- . Atomic Energy Canada Ltd (AECL)
- . Northern Telecom
- . IBM
- . Hewlett-Packard
- . US Army Corps of Engineers
- . US Air Force
- . Ontario Hydro
- . Dome Petroleum
- . Quebec Hydro
- . National Research Council
- . Texasgulf

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics; 8=Energy;
9=Environment; 11=Lasers; 15=Radar; 18=Space Systems;
19=Testing/Test Equipment; Analog=5; Fiber Optics=5, 7; C3=5; Lasers=5;
Optical=5; Radio=5; Video Systems=5; Telemetry=5, 19; Digital=5; Wideband=5;
Switching=5; Secure=5; Telephone=5; Receivers=5; Transmitters=5; Modems=5;
Tactical=5; Microprocessors=6; Programming=6; Instrumentation=6, 9, 19;
Applications=6; Data Analysis=6, 9, 19; Data Acquisition=6, 9, 19;
Data Handling=6, 9, 19; Data Processing=6, 9, 19; Real Time=6;
Process Control=6; LEDs=7; Avalanche Detectors=7; Laser Diodes=7, 11;
Seismic Sensors=7, 9; Fusion Splicers=7; Power Measurement=7; PCB=7; Design=7,
19; Development=19; Manufacturing=7; Systems=7; Components=7; Wind=8;
Automatic Weather Station=9; Moisture Content=9; Air Infiltration=9;
Communications=11; Phased Array=15; Ground Stations=18; Laboratory=19.

REVISED: May 82.

COMPANY: GANDALF DATA Ltd

CODE: GDC

ADDRESS: 9 Slack Rd
Ottawa, Ontario, Canada K2G 0B7

CONTACT: Mr. Peter Kawchak, VP Sales - (613) 225-0565

HISTORY: Gandalf Data Ltd is a subsidiary of Gandalf Technologies Inc, a publicly owned Canadian Company. Gandalf Data Ltd is Canada's largest manufacturer and supplier of digital data communications equipment - products which connect terminals and computers over communications paths to permit data exchange. Other subsidiaries of Gandalf Technologies Inc include Gandalf Data Inc - Wheeling, Illinois (since 1975), and Gandalf Digital Communications Ltd - Woolfton, Cheshire, England (since 1978). The data transmission needs of the US and UK are supplied by these two subsidiaries - the Canadian installation serves Canada's needs as well as the remainder of the international market.

CAPABILITY: Gandalf Data Ltd is a multi-million dollar enterprise serving the international market in the computer communications field, providing state-of-the-art expertise in the design, development and manufacture of data transmission hardware and related products. Over the years, Gandalf has invested 5-12% of its sales dollars in Research and Development. The company directs its energies towards three basic areas of endeavor - the enhancement of existing products to improve cost and production; the extension of existing product lines; and the development of new data communications products. To this end, Gandalf devotes a significant portion of its energies towards R&D.

AVERAGE WORK FORCE: Engineers - 100
Total - 840; 450 (Canada), 320 (US), and 70 (UK).

GROSS SALES: 1979 - \$13.0M (Total); \$ 4.2M (Canada)
1980 - \$26.0M (Total); \$ 8.1M (Canada)
1981 - \$40.2M (Total); \$15.9M (Canada)

PLANT SIZE: Ottawa - 107,000 sq ft
Hull, Quebec - 22,000 sq ft
US - 97,500 sq ft
UK - 17,354 sq ft

EQUIPMENT: Gandalf has advanced the state-of-the-art with their local data sets and medium distance modems; these range from devices capable of transmitting data at speeds up to 256 kilobits per second over distances up to one-half mile, to those which can transmit data at speeds of up to 2400 bps up to 16 miles. The unlimited distance superModem II transmits with superior noise performance over voice-grade telephone lines at 9600 bps. Data transmission equipment also includes the PIN (Private Intelligent Networker) series of multiplexers - sophisticated microprocessor-based data concentrators. This line incorporates the PIN 9101, an X.25 Network Interface unit. Gandalf provides the PACX (Private Automatic Computer Exchange) System, a switching system for data terminals which provides contention, switching, queuing routing, etc. The modem line is supplemented by the unique radio Modem designed for use with VHF and UHF radio channels, and especially useful in remote areas where conventional telephone lines are not available. Gandalf

also provides the MDT 3601, a microprocessor controlled mobile data terminal suitable for use with most land-based mobile radio systems. Used as part of a computer dispatch system, the terminal can greatly benefit fleet management.

EXPERIENCE: A broad customer base includes common carriers, telephone companies, government departments, financial houses, educational institutions and industrial plants.

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics; Radio=5; Modems=5; Switching=5; Multiplexer=5; Digital=5; Data Communications=5, 7; Computer Communications=6.

REVISED: May 82.

COMPANY: GARRETT MANUFACTURING Ltd

CODE: GML

ADDRESS: 255 Attwell Drive
Rexdale, Ontario, Canada M9W 5B8

CONTACT: Mr. B W Atkinson, New Tech Sales Mgr - (416) 675-1411

HISTORY: Garrett Manufacturing Ltd (GML) is a wholly owned subsidiary of the US based Garrett Corporation. The Garrett Corporation, Mack Truck, United Oil Products, and Ampex are the major components of the Signal Companies, one of the 100 largest US corporations with 1981 sales of \$5.3B.

A Garrett office was established in Canada in 1952 to provide sales and services support for Garrett products in Canada. One year later, the company established a repair and overhaul facility near Toronto International Airport and added an engineering department to support this endeavor.

Throughout the 1950s, Garrett expanded its engineering department, added a production department and began the design and manufacture of ground equipment for the Canadian aircraft industry. In 1961, Garrett Manufacturing Ltd assumed a world product mandate for design, development and production of electronic temperature controls. These controls are a major subsystem of the Garrett environmental control systems that fly on more than 70% of the commercial and military aircraft in the western world.

Garrett Manufacturing Ltd now supplies a broad mix of products and services to the world aerospace industry. Garrett's aerospace products include aircraft cabin, cockpit and compartment temperature controls; windshield heat controls; airflow sensing and control systems; engine speed sensors; radio communication equipment for personnel and air traffic control applications; specialized cockpit displays; ground test equipment for aircraft air data systems; and custom thick and thin film hybrid microcircuits. GML is the Canadian repair and overhaul base for other Garrett products used in Canada. In addition, GML assembles and tests electronic equipment on a "build to print" basis, in support of offset procurement requirements.

CAPABILITY: The company is actively engaged in research and development in control systems, RF communications, and analog and digital circuit design, to support existing products and create new opportunities. Environmental and EMI testing to military/aerospace standards is performed in Garrett's approved test facilities.

A single standard quality control system conforming to DND 1015 and meeting the requirements of MIL-Q-9858 and NATO AQAP.1 is employed by the company. DND maintains a resident detachment in the plant which will on request, provide reciprocal inspection services for the US DOD and other NATO governments.

All of the major airframe manufacturers in the US have surveyed and approved GML's facility and control systems as being acceptable for the manufacture of both military and commercial aircraft equipment.

Garrett products include:

Microcircuits - GML's microelectronic products are produced in a fully

integrated facility with dedicated engineering, sales and production staff. This facility produces thick and thin film hybrid microcircuits. GML's microcircuit installation is equipped with many million dollars worth of specialized manufacturing and research equipment including automatic laser trimming, computer-controlled testing and an electron beam scanning microscope. This facility is producing microelectronic devices to military specification for the military and aerospace industries.

Temperature Control Systems - GML's temperature control systems usually consist of electronic control boxes; temperature and/or airflow sensors; and temperature selectors. The most recent designs, featuring microprocessed-based digital electronics for improved performance and increased reliability, are in production for Boeing's 757/767 programs. Garrett temperature controls are used in cabin, cockpit and compartment air conditioning systems; wing anti-ice temperature control systems; window heat control systems, and some liquid coolant systems. In addition to the Boeing 757/767, Garrett systems are in use on A300, A310, DC-9, DC-10, 727, 737, 747, F-14, F-15, F-16, F-18, Viggen, EF-111A, Gulfstream II/III, Challenger, HS-125, IAI 1124/1125, Sabreliner, Learjet 54/55, HU-25A Guardian, SRR, and Hughes AAH. Most of the major commercial, military and business aircraft in the western world use Garrett temperature control systems.

Communications Systems - Emergency Locator Beacons developed by GML are used throughout the world in military, commercial and general aviation applications. These low power transmitters automatically provide an emergency homing signal to assist search aircraft to locate an aircraft in distress. Personal Locator Beacons and Survival Radio Sets for military users permit two-way voice communication with search aircraft as well as providing an emergency homing signal. VHF/AM Single Channel Transmitters and Receivers are produced for civil and military aviation air traffic control communications. Installed at air radio facilities, this ground station equipment offers many performance and maintenance features not previously available.

Peripheral Vision Display - the PVD is a subliminal attitude change indicator for cockpit work-load reduction and pilot disorientation prevention. It operates on the principle that orientation information is sensed primarily by a person's peripheral vision system and is processed subconsciously by dedicated areas of the brain.

Major System/Subcontract Manufacturing - the "Major System" aspect of this activity offers many attractive opportunities to foreign suppliers seeking to sell systems/equipment to the Canadian Government by utilizing Canadian manufacturing and systems engineering facilities and capabilities. Through licensing, teaming, joint venture agreements and by direct involvement through technology transfer, shared joint development, advanced R&D, the Canadian Offset/Industrial Benefits requirements of major procurements can be accomplished. Our Subcontract Manufacturing "build to print" service enables our customers to meet demanding delivery schedules, by employing our highly experienced manufacturing groups and facilities including aerospace standard quality assurance and modern Automatic Test Equipment. These services, backed up by a high-technology team, employing the latest in design and manufacturing techniques provide more effective co-operation in major procurement programs.

Repair and Overhaul/Customer Support - GML's customer support/repair and

overhaul facility is unique in Canada. It is the only facility outside of Air Canada's Montreal base and CP Air's Vancouver facility that has the capability to simulate conditions for testing airborne air conditioning rotating machines and high temperature valves. These facilities are also equipped to repair and overhaul gas turbine auxiliary power units, actuators, starters, central air data computers, other aircraft systems, and turbochargers for tractor, truck and automotive applications.

AVERAGE WORK FORCE:

Engineering	- 150
production	- 550
Qual Ins/Customer Support	- 100
Others	- 100

GROSS SALES: 1981 - \$56M
Forecast growth pattern - 10 to 12%

PLANT SIZE:

Main Plant/head Office	- 75,000 sq ft
Product Support Facility	- 34,000 sq ft
Taber Road Facility	- 12,000 sq ft
GML Microcircuit Facility	- 21,000 sq ft
Engineering Facility	- 33,000 sq ft

EXPERIENCE: GML customers are world-wide and include both the commercial and military sectors.

KEYWORDS: 1=Aircraft; 3=Avionics; 5=Communications; 7=Electronics;
16=Security & Safety; 17=Software Services; 19=Testing/Test Equipment;
Cockpit Displays=3; Crash Position Indicator=3, 16; Environmental Controls=1;
Environmental Instruments=1; Beacons=1, 3, 16; Repair & Overhaul=3;
Measurement & Control Systems=3; Power Supplies=7;
PC Board Design & Fabrication=7; Radio Communication Gear, Fixed, Mobile=3, 5;
Solid State Devices=7; Thick Film Hybrid=7; Thin Film Hybrid=7;
Voltage Transformers, Regulators, Hi/Lo Voltage=7;
Emergency Locator Beacons=3, 16; Design to Requirements=17;
Test Equipment & Instrumentation=19;
Air Traffic Control Communications Systems=5; Peripheral Vision Display=3.

REVISED: May 82.

COMPANY: GENERAL MOTORS OF CANADA Ltd
Diesel Division

CODE: GMC

ADDRESS: P. O. Box 5160
1991 Oxford St East
London, Ontario, Canada N6A 4N5

CONTACT: Mr. W L Claggett, Mgr, Tech Sys Def Prod Sales - (519) 452-5245

HISTORY: The Diesel Division of General Motors of Canada Ltd was established in 1941 for the manufacture of diesel electric locomotives. The Diesel Division is a wholly owned subsidiary of General Motors of Canada Ltd, which in turn is wholly owned by General Motors Corp.

CAPABILITY: The Diesel Division is primarily involved in the engineering and manufacture of locomotives, General Motors coaches, and Terex off-highway vehicles. They also design and manufacture armored and general purpose vehicles for the Canadian Forces, the latest of which is a six wheeled amphibious unit designated AVGP. It is being supplied in three models - a personnel carrier, a fire support vehicle, and a maintenance recovery unit.

AVERAGE WORK FORCE: Engineers - 40
Others - 2838

GROSS SALES: 1980/81 - \$608M

PLANT SIZE: Main Plant - 866,000 sq ft
Highbury Ave Plant - 267,000 sq ft
St Eustache Plant - 138,000 sq ft

EXPERIENCE: The Diesel Division has been under contract with the US Navy for a design study for a Hybrid Mobile Protected Weapon System and has recently been awarded a contract for 60 light armored vehicles (LAV) by the US Army Tank Automotive Command. This award is the first year of a 5-year contract for 969 vehicles. The first vehicles are to be delivered in approximately 12 months to meet an urgent USMC requirement. Total contract is for \$477.8M and makes maximum use of off-the-shelf equipment. A companion 24-month R&D contract was also awarded in the amount of \$21.6M. This latter contract requires the fabrication and test of a family of five vehicles, which will be variations of the basic vehicle, adapted to meet specific requirements. The Diesel Division has also participated in the MX Missile Carrier Program through Delco Electronics and bid on the US Army Infantry Fighting Vehicle Second Source Program. Since their beginning, they have supplied more than 3000 locomotives to 29 domestic customers and have exported more than 500 units for 15 railways in 12 countries. They are currently under contract to supply \$155M worth of locomotives to Egypt. Since they began building coaches in 1961, they have supplied 7200 units across Canada.

KEYWORDS: 2=Armament; 14=Protective Equipment; 20=Miscellaneous;
Locomotives=20; Off-Highway Vehicles=20; Armored Vehicles=20;
GP Armored Vehicles=20; Amphibious Vehicles=20; Personnel Carrier=20;
Fire Support Vehicle=14, 20; Maintenance Recovery Vehicle=20;
Hybrid Mobile Protected Weapon System=2; Ground Transportation=20;
Transporter Systems=20; Light Armored Vehicles=20.

COMPANY: GLENAYRE ELECTRONICS Ltd

CODE: GEL

ADDRESS: 1551 Columbia Street
North Vancouver, British Columbia, Canada V7J 1A3

CONTACT: Mr. K A Spencer, General Manager - (604) 980-6041

HISTORY: Glenayre Electronics Ltd is a Canadian owned company incorporated in 1963. There are no other Canadian locations. The company has a US subsidiary, Glenayre Electronics Inc, located in Blaine, Washington. The US corporation is a sales and service outlet for products designed and manufactured by the Canadian parent company.

CAPABILITY: The products and projects of Glenayre are organized into three groups - Communications, Transportation systems, and Instrumentation and Control Panel assembly. Standard products are offered as well as custom products and systems based on customer requirements. A heavy commitment to R&D is maintained to insure the company remains abreast of current technology. Heavy emphasis is placed in the telecommunications area. They have developed and now manufacture an advanced Mobile Telephone Control Head (GL2020) - a microprocessor-based unit featuring automatic call initiation. Also developed and manufactured are the scanning control head; tone equipment, such as a radio-telephone terminal incorporating microprocessor control and fully solid state audio switching. They are also developing microprocessor control heads and communications management hardware for larger fleet operators. They have just announced a selective signalling series of modules for private network signalling on 4-wire lines.

Glenayre has recently entered the area of HF data communication systems with a 300 bps modem for SSB radios. It uses pulse compression techniques to achieve unusual resistance to frequency selective fading, narrow band interference, frequency misalignment and clipping, and is well-suited for use in ARQ protocols. A data link controller with FEC, ARQ and sel-call will soon be announced.

In the area of transportation systems, they design and manufacture automatic vehicle monitoring systems for application to railroads and open-pit mining. These systems generally involve buses, trains, trucks and subway cars. New product development includes a proximity beacon for locating non-tracked equipment and a low-priced transponder suitable for electronic identification of anything from freight cars to personnel in a security sensitive area.

They offer a line of power converters (DC-DC) designed for fixed or mobile operation, are of compact design and have a broad range of input and output voltages. They also produce power supply packages for data processing, communications and other industries. Included in the Glenayre plant is a fabrication and assembly facility for industrial control and switchboard applications.

<u>AVERAGE WORK FORCE:</u>	Engineering	- 50 (4 PhDs, 5 MSs & 33 BS level Grads)
	Production	- 75
	Others	- 25

GROSS SALES: 1979 - \$ 5M
1980 - \$ 8M
1981 - \$12M

PLANT SIZE: 33,500 sq ft

EQUIPMENT: Of the above floor space, 10,000 sq ft is devoted to manufacturing. They maintain a metal fabrication shop, paint shop, assembly area, and fully equipped test, service and quality control departments.

EXPERIENCE: Glenayre Electronics Ltd has worked with several countries such as the US, Mexico, Australia, and with private industry and Provincial Governments across Canada. There has been no direct work with the USAF, although they are interested in selling to the USAF.

KEYWORDS: 5=Communications; 7=Electronics; 16=Security & Safety;
20=Miscellaneous; Control Heads=5; IMTS Terminals=5;
Vehicle Location & Identification=20; Power Supplies=7;
Selective Signalling=5; Mobile Communications=5; Radiotelephone=5;
Vehicle Identification=20; Truck Dispatch=5; Train Dispatch=5; Transponder=7,
16; Proximity Beacon=7, 20; Vehicle Monitoring=20; Power Converters=7;
HF Radio Data Systems=5; Modems=5; HF Modems=5.

REVISED: Jun 82.

COMPANY: GLOBAL THERMOELECTRIC POWER SYSTEMS Ltd

CODE: GTP

ADDRESS: P. O. Box 90
Bassano, Alberta, Canada T0J 0B0

CONTACT: Mr. Donald W Peterson, President - (403) 641-3512

HISTORY: Global is a privately held Canadian company that was incorporated in 1975. The Global operation, originating employees, equipment, and thermoelectric science & technology, was originally a major part of the Thermoelectric Division of 3M Company of St Paul, Minnesota. All facilities are at the above Canadian location.

CAPABILITY: The Global corporate mission is the commercial application of mature, field-proven remote power technology, coupled with an ongoing commitment to research & development of promising remote power technologies. They are regarded as a complete manufacturing and marketing organization, and as a result of the above mission, are engaged in extensive R&D of thermoelectrics, combustion, and electronics. Their Bassano headquarters accommodates both administrative and production facilities, as well as an engineering department, and research & development laboratories.

Global's product is a line of high reliability thermoelectric power systems for remote unattended stations requiring 10 to 1000 watts continuously. They have provided the Sandia Laboratories with power systems for SALT-type monitoring in the USSR-systems that not only provide the required power, but cannot be undetectably tampered with. This latter property results from the fact that the Global power systems have no moving parts and generally do not malfunction. Their production capacity is about 16 generators per week. Manufacturing of the thermoelectric generators is accomplished through various stages of mechanical and electronic assembly, backfilling, lead checking, and basic machining. Their shop capabilities can easily hold tolerances to the required ± 0.001 inch. The high technology semiconductor thermoelectric materials and hermetically-sealed thermopile power units are manufactured entirely on site. This is predominately for reasons of quality control and due to the highly specialized skills and equipment required. They are apparently the world's sole commercial source for sintered, doped lead-telluride thermoelectric elements meeting the US Government's standard for 3M-type ES1101 characteristics. It is interesting to note that Global thermoelectric generators have powered telemetric transmissions back to earth during Apollo moon missions. Their systems are performing today in some 40 countries, accumulating a total of well beyond 15,000 years of reliable operations.

Recognize that while thermoelectrics is a relatively mature technology, the development of remote power in general is still in its infancy. The company is therefore striving for the development of lower cost, more widely applicable power sources incorporating proven thermoelectric technology with newly developing manufacturing techniques. Their applied research is directed toward the fields of solid state physics, heat transfer & storage, and gas & fluid dynamics while development is actively underway in combustion technology, thermoelectric metallurgy, piezoelectric ultrasonic atomization, electronic & electrical engineering, and new burner systems. An additional goal is to improve their attainable weight to power ratio by a factor of 2.

Their current units range from about one pound per watt for convection cooled units to 0.2 pound per watt for forced convection cooled units. Recent ongoing experiments were in the areas of fuel atomization and increasing the combustion characteristics of diesel fuel. This R&D has led to the production of 10 units for Nippon Electric Co of Japan for delivery to Madagascar. These are convection cooled units using primarily Bunker C-Type fuel.

Global has recently been funded by the Canadian Government to a level of approximately \$2M (1982). This level of funding is expected to continue for the next five to six years. The goal is to lower the production cost of thermoelectric generators, thereby lowering the cost per watt of electrical power produced.

AVERAGE WORK FORCE: PhDs - 1
 Engineers - 21
 Others - 38

GROSS SALES: \$2.0M (Historical)
 \$2.3M (Current - 1981)
 \$3.1M (Projected - 1982)
 \$2.0M (Funded R&D - 1982)

PLANT SIZE: 24,000 sq ft (8,000 sq ft additional by Spring 1983)

EQUIPMENT: Because of the special requirements associated with the manufacturing of long life, hermetically sealed semiconductor thermopiles, Global has special equipment/instruments such as a helium mass spectrometer, TIG & MIG welding equipment, induction heater (for preparation of special alloys), and vacuum & back filling equipment.

EXPERIENCE: Global's power systems markets are in the areas of telecommunications (radio repeater sites); cathodic protection; telemetry; supervisory control & signals; and navigation & positioning. Customers include US EPA, US Army, Exxon Corp (US), Mountain Bell (Boise, Idaho), Continental Telephone of the West (Phoenix, AZ), Texas Instruments, Teledyne Geotech, Amoco Pipeline Co (New Mexico), Nippon Electric Co, ARAMCO/PETROMIN (Saudi Arabia), Algeria Post & Telegraph (Algeria), Abu Dhabi National Oil Co, Shell Canada, Marinav Corp (Canada), Offshore Navigation Canada Ltd, NNPC (Nigeria), and Dome Petroleum (Canada). As can be seen, Global has world-wide experience with major organizations. They are currently working with the US Army and indirectly with the USAF (ASD) through the USA. They are interested in working directly with the USAF and appear to have considerable technology and experience to offer. They are very R&D oriented in addition to offering a reliable product line.

KEYWORDS: 4=Chemistry; 5=Communications; 7=Electronics; 8=Energy;
20=Miscellaneous; Power Supplies=5, 7, 8; Remote Power Supplies=5, 7, 8;
Auxiliary Power Units=8; Thermoelectric Power Units=8;
Unattended Power Supplies=8; Generators=8; Thermoelectric Generators=8;
Applied Research=4, 8, 20; Combustion Technology=8, 20;
Thermoelectric Research=8.

REVISED: Oct 82.

COMPANY: GOODWOOD DATA SYSTEMS Ltd

CODE: GDS

ADDRESS: 150 Mill St
P. O. Box 210
Carleton Place, Ontario, Canada K7C 3P4

CONTACT: Mr. Joseph I Krebs, Vice President - (613) 257-3610

HISTORY: Goodwood Data Systems Ltd is a Canadian owned high technology electronics company founded in 1976. It was originally owned by I. P. Sharp Associates Ltd, a Toronto based computer hardware and software consulting company. The company has a US subsidiary, Goodwood Data Systems Inc., located in Ogdensburg, NY.

CAPABILITY: Goodwood is primarily involved in the design and manufacture of aviation data handling systems, weather processing systems, and computer aided learning systems. They also design and manufacture video display systems, data acquisition systems, communication monitors, flight strip printing systems, plus other electronic equipment. Their airport information processing systems, designed for air traffic control, weather forecasting, and passenger movement, are in use at the international airports serving Toronto, Ottawa, Montreal, Winnipeg, Edmonton and Vancouver. Their human resources allows them to cover the broad areas of engineering (including system logic and design); software design and development, systems management; product assurance (including reliability and maintainability analysis); production (including O&R); quality assurance; documentation and training. Their computer aided learning system, known as AVCAT (Audio Visual Computer Aided Trainer), provides individualized audio/visual based instruction with record keeping, student management, and full lesson authoring and editing capability.

AVERAGE WORK FORCE: PhD - 2
Engs - 14
Others - 29

GROSS SALES: 1980 - \$1.3M
1981 - \$2.5M

PLANT SIZE: 19,532 sq ft - Main Building
4,910 sq ft - Storage, Boardroom & Boiler Buildings

EXPERIENCE: Present customers include various departments in the Canadian Government and industries in both Canada and the US. They are interested in doing business with the USAF.

KEYWORDS: 7=Electronics; 9=Environment; 17=Software Services;
18=Space Systems; 20=Miscellaneous; Repair & Overhaul=7;
Solid State Devices=7; Data Acquisition=17; Data Processing=17;
Design to Requirements=17; Transportation Control Systems=17;
Meteorological Stations=9, 20; Meteorological Instruments=9, 20;
Satellite Subsystems=18; Satellite Weather Forecasting=9, 18, 20;
Satellite/Radar Rain Forecasting Systems=9, 18, 20; Atmospheric Monitoring=9;
Systems Analysis=17, 20; Systems Processing=17, 20; Hydrological Systems=9;
Flight Information Display Systems=7, 17, 20; Airport Status Systems=9, 20;

Airport Meteorological Systems=9, 20; Computer Aided Learning Systems=20;
Air Traffic Control Systems=20.

REVISED: Jul 82.

COMPANY: GREAT LAKES FORGINGS Corp

CODE: GLF

ADDRESS: 1590 Matthew Brady
Windsor, Ontario, Canada N8S 3K6

CONTACT: Mr. Al Simone, Sales Manager - (519) 945-1151

HISTORY: Great Lakes Forgings Corp is Canadian owned and was incorporated in 1950 with no other locations in Canada or the US.

CAPABILITY: Great Lakes Forgings Corp is a closed die forge shop and produces low carbon and alloy steel forgings. Their product line - forged rivetless conveyor chains - are used in material handling systems and account for 50% of their current business.

AVERAGE WORK FORCE: Total - 120

GROSS SALES: 1981 - \$10M
1982 - \$12M (projected)

PLANT SIZE: 18,000 sq ft (Forging Plant)
12,000 sq ft (Heat Treatment Plant)

EQUIPMENT: Great Lakes Forgings Corp is equipped with 8 air and hydraulic forging hammers.

EXPERIENCE: Prime customers of Great Lakes Forgings Corp include American Chain and Cable (US, Canadian & Italian Divisions), as well as the automotive industry (Chrysler, Ford, etc). Unikey Corp (US) is a major customer in the materials handling area. They are also supplying two US firms with forged hooks for military end use.

KEYWORDS: 12=Machining; Precision Forging=12; Forging=12; Chains=12;
Rivetless Chains=12; Steel Forgings=12; Closed Die=12.

REVISED: Aug 82.

COMPANY: HAMMOND MANUFACTURING COMPANY Ltd

CODE: HMC

ADDRESS: Corporate Office
394 Edinburgh Road
Guelph, Ontario, Canada N1H 1E5

Electronic Transformer Division
95 Curtis Drive
Guelph, Ontario, Canada N1K 1E1

CONTACT: Mrs. Janice Husson, Marketing Services Manager - (519) 822-2960

HISTORY: Hammond Manufacturing Company Ltd was formed in 1927. There are presently three divisions - Electronic Transformer Division, Electrical Transformer Division, Cabinetry Division; and sales and technical services offices in Montreal, Toronto, Winnipeg, Calgary, and Vancouver (Canada). There are also sales and technical service offices located in Buffalo, NY, and Dallas, TX. Hammond Manufacturing is a privately owned Canadian company.

CAPABILITY: The company is involved in the manufacture of a wide range of magnetic devices for the electrical/electronic industry. Specific areas are outlined below:

- . High Voltage Design and Fabrication - high voltage transformers are designed, wound, assembled, and tested at the Electronic Transformer Division (Guelph). Fabrication of sheet metal cases and special mechanical mountings are manufactured by the Cabinetry Division (Guelph). The company has been manufacturing custom designed high voltage transformers since 1940 for functions such as radar, dielectric testing, HV power supplies, medical electronics, modulation transformers, electrostatic speakers, and electronic air cleaners. They have design and manufacturing capability for single and three phase units.
- . High Voltage Testing - the Electronic Transformer Division has in-house test capabilities up to 50 KV RMS, 60 Hz dielectric testing, Corona testing at 60 Hz to 400 Hz per MIL-T-27 specification. Specification: Available for testing at the Electrical Transformer Division - dielectric up to 80 KV RMS, up to 200 KV DC (high impedance loading), and up to 175 KV impulse. Test equipment is of commercial and custom manufacture.
- . Case design for containing special transformers and fabrication is available to withstand pressure due to liquid expansion. Includes water cooling.
- . Leak detection per MIL-T-27.
- . Vacuum processing is available for silicone and mineral transformer oils as well as mineral and epoxy varnishes and potting epoxy, or compounds.
- . Oil filling available. At present, there is no gas filling of high voltage transformers.

- Low Voltage Transformers - power, trigger, Audio High Frequency, pulse, and reactors are designed and fabricated at Electrical Transformer Division. Capabilities range from microwatt devices up to kilowatt level in single, two and three phase configurations at frequencies ranging from 10 Hz to 150 KHz. Physical characteristics range from standard EI laminations through "C" core, wound core, toroidal, pot core, etc., in materials of silicone steel, nickel alloy, mu metal, ferrite, powdered iron and air core transformers and reactors.
- Current and Pulse capabilities - Electronic Transformer Division, current to 10A, pulse to 10KV; and Electrical Transformer Division, current up to 50,000A.
- Military requirements - designed to meet MIL-T-27 available with certificate of conformance. The company inspection system is established to Department of National Defense specification DND 1016, (equivalent to MIL-I-45208). They are presently in the second stage of applying for recognition of a Quality Program to DND 1015 (equivalent to AQAP-1 NATO Quality Control Systems Requirement for Industry and Military Specification MIL-Q-9858A Quality Program Requirements).
- Source surveillance and government source inspection available by DND Canadian Forces Technical Service Depot 302 (Guelph).

AVERAGE WORK FORCE: Corporate (Total) - 1100
Electronic Division - 130

GROSS SALES: 1979 - Corporate/\$28.3M; Electronic Division/\$2.9M
1980 - Corporate/\$33.7M; Electronic Division/\$3.1M
1981 - Corporate/\$44M; Electronic Division/\$4.3M

PLANT SIZE: Electronic Division - 20,000 sq ft
Electrical/Cabinetry Division - 175,000 sq ft
Other Manufacturing Plants - 50,000 sq ft
Warehouse Facilities - 100,000 sq ft

EQUIPMENT: Electronic Transformer Division - (Winding) multiple/gang coil winders, unit coil winders, toroidal coil winders, bobbin coil winders, RF choke winders; Automated stacking/laminating machines, vacuum impregnating/potting encapsulating/casting tanks; (Ovens) Baking and curing ovens; (Environmental) Heat, altitude, cold (plans for 1982 include a complete environmental lab, including shock, vibration, salt spray, humidity, etc.).

EXPERIENCE: Hammond Manufacturing has been involved with military projects since 1939. They are presently supplying magnetics to Canadian and US manufacturers of the power supply for the gun turret fire control computer for the M-1 Main Battle Tank. Hammond Manufacturing also supplies magnetics for/to - Canadair Challenger Aircraft; Atomic Energy of Canada Ltd "THERAC" Series of Linear Accelerators; Satcomm Ground Communications Stations for NATO; Garrett Manufacturing; Collins Radio; Varian Canada; Bell Canada; Canadair; De Havilland Aircraft; Canadian General Electric; ITT; Computing Devices Company; National Research Council of Canada; Department of National

Defense; Department of Supply & Services; Sperry Univac; Raytheon Canada; Atomic Energy of Canada; Ward Beck Systems; McCurdy Radio; McCurdy Communications; Litton Systems; and universities and research groups.

KEYWORDS: 7=Electronics; 12=Machining; 15=Radar; 19=Testing/Test Equipment; Magnetic Devices=7; High Voltage Transformers=7, 15, 19; Sheet Metal Cases=7, 12; Mechanical Mounts=7, 12; Dielectric Testing=7, 19; Corona Testing=7, 19; Leak Detection=7, 19; Oil Vacuum Processing=7; Oil Filling=7; Low Voltage Transformers=7; Current/Pulse Capabilities=7.

REVISED: Jul 82.

COMPANY: HANDS FIREWORKS Inc

CODE: HFI

ADDRESS: 221 Nipissing Road
Milton, Ontario, Canada L9T 1R3

CONTACT: Mr. R A Brown, General Manager - (416) 878-2831

HISTORY: Hands Fireworks Inc was established in 1873 for the purpose of making domestic display fireworks. Early in World War II, the company converted completely to the manufacture of military pyrotechnics which have been a major product ever since. Hands Fireworks Inc became the major pyrotechnics and fireworks producer in Canada. During WW II, a wide range of pyrotechnics were manufactured for most of the allied countries and included such items as US BM 8Al Flare, the 4.5 inch Reconnaissance Flare, 2 inch Parachute Illuminating Flares, Verrey Pistol Cartridges of all types, and smoke signals.

In 1977, the company was purchased by Lorcon Inc and operated as a division, Hand Chemical Industries. Recently, the operations became a wholly owned subsidiary of Lorcon Inc and now operates as Hand Fireworks Inc.

CAPABILITY: Hands Fireworks Inc operates from two plants - one at Milton, Ontario (near Toronto), and the main plant at Papineauville, Quebec (between Ottawa and Montreal), with a research laboratory at Thurso, Quebec (15 miles from Papineauville). The production plants are typical for this industry, being constructed of fire resistant materials and consisting of many individual buildings thereby keeping the amount of explosive, flammable, dangerous or toxic materials and the number of operators involved to a minimum.

Each specific operation or storage area has been carefully analyzed for degree of hazard and is designed to minimize these hazards by steel or reinforced concrete walls, protective steel guards, remote control of operation, special protective devices such as explosive activated fire extinguishing equipment, protective screens between buildings, special electrical wiring, etc. The process, materials, quantities of explosive, type of protection, etc., are licensed yearly by the Federal Department of Energy, Mines and Resources, followed up by frequent plant inspections by this department throughout the year.

The Milton facility includes one laboratory/test building, one office building, two explosive storage magazines, and one raw materials storage building. The Papineauville facility includes one laboratory/test building, one office building, 50 process buildings, 9 explosive storage magazines and 32 raw material storage buildings. The Thurso facility includes one laboratory/test building.

The fireworks line is completely integrated starting with the basic raw materials, paper, and chemicals, and converting them into spiral wound paper tubes from 1/4 to 3 inch inside diameter, mixing the chemicals, pressing, drying, labelling and packaging. The plastic components which hold the delay charges and bursting charges are purchased from outside sources, but are produced from company molds. The smokeless and black powders used are purchased from outside sources.

A new production site has been purchased in the Prescott, Ontario area and encompasses 300 acres. Initially the site will be used for distribution and research, with development facilities and production lines to follow.

AVERAGE WORK FORCE: Professionals - 8
Others - 105

GROSS SALES: 1981 - \$4.3M

PLANT SIZE: 80,000 sq ft on approximately 100 acres (Total)

EXPERIENCE: Hands Fireworks Inc has worked very closely with the Department of National Defense (DND) and various Canadian Design and Development facilities such as the National Research Council; the Defense Research Establishments in Valcartier, Quebec and Suffield, Alberta; and the Chief Inspector of Explosives of the Department of Energy, Mines and Resources. Development work has been done for the Department of Agriculture. Some major projects have included:

- . The design and development of the Grenade, Hand, Smoke (HC), and C1A1.
- . The design and development of the Smoke Pot, SC39 and SC390. This long burning (11 to 18 minutes), high volume smoke pot has recently been tested by the DOD at Dugway, Utah.
- . The design and development of the Disperser Chemical Goundburst, and the Disperser Chemical Airburst, both of which are currently being evaluated by DND.
- . The manufacture of the igniter for the Black Brant Rocket.
- . The design, development and production of the Signal, Illumination 1 1/2 inch (plastic case) Red, Yellow, Green, etc., currently in service with the Canadian Forces.
- . The design, development and manufacture of the Silver Rainmaker shell which was used successfully to produce rainfall to fill reservoirs for irrigation.
- . The design, development and production of the 2 minute Smoke Pot Orange.

In the last three years, 9 contracts with the Canadian Government were completed for a total of \$6,625,000. These contracts included Chemical Airburst Simulators, Smoke Pots, Markers Location Marine, Grenades Hand Smoke, Cartridges Signal Practice Bomb, and Signals Illumination. The company has done extensive work on the purification and stabilization of red phosphorus to MIL SPEC 1760A and is presently supplying US contractors.

KEYWORDS: 2=Armament; 4=Chemical; Chemical Airburst Simulators=2, 4;
Smoke Pots=2, 4; Markers=2, 4; Spotting Changes=2, 4; Grenades Smoke=2, 4;
Hand Grenades Smoke=2, 4; Signal Cartridges=2, 4; Illumination Signals=2, 4;
Practice Bomb Signal Cartridges=2, 4; Orange Smoke=2, 4; Red Signal=2, 4;
Yellow Signal=2, 4; Green Signal=2, 4; Igniters=2, 4; Rocket Igniters=2, 4;

Chemical Groundburst Simulators=2, 4; High Volume Smoke Pot=2, 4; HC Smoke=2, 4; Pyrotechnics=2, 4; Flares=2, 4; Chemical Dispersers=2, 4; Ammunition Smoke=2, 4; Ordnance=2, 4.

REVISED: Aug 82.

COMPANY: HERMES ELECTRONICS Ltd

CODE: HEL

ADDRESS: 40 Atlantic St
Dartmouth, Nova Scotia, Canada B2Y 4A1

CONTACT: Mr. K A Hatchard, Marketing & Admin Mgr - (902) 466-7491

HISTORY: Hermes is the successor of the Canadian branch of EMI Electronics of the UK. It was established in 1949 and has specialized in anti-submarine warfare products, certain areas of HF Communications, and oceans/environmental data systems products.

CAPABILITY: The company's products include:

Sonobuoys and Bathythermograph Buoys - production types include AN/SSQ-41A, AN/SSQ-41B and AN/SSQ-36. The AN/SSQ-53B and others are under development.

Ionospheric Sounding Equipment - vertical and oblique sounding equipment is manufactured and is in service on a worldwide basis. The AN/FPT-11 transmitters, AN/UPR-2 receivers, and their commercial counterparts represent the last generation of this equipment.

HF Antennas - a unique active broadband aperiodic loop array is produced. Various configurations of this system are in service in twenty-three countries and fifty-four agencies of various governments.

Moored and Drifting Data Buoy Systems - buoy vehicles for the collection, recording and retransmission of oceanographic, meteorological, and environmental data have been developed and systems engineered for government, institutional, and industrial users. Hermes developed the Canadian Ocean Data Systems Buoys for the Canadian Government in 1975.

Environmental Data Systems - ice stations and automatic weather stations have been developed and manufactured for industrial and government users.

AVERAGE WORK FORCE: 400 (including 75 engineers, technicians, draftsmen and engineering support staff).

GROSS SALES: No Data

PLANT SIZE: 137,600 sq ft

EQUIPMENT: They have a fully equipped environmental testing laboratory as well as a comprehensive manufacturing facility. Their environmental laboratory is one of the largest in Eastern Canada and contains vibration equipment, humidity and temperature chambers, shock and tensile testers, and high pressure testing tanks. The equipment meets the requirements of MIL-STD-810 for Environmental Test Methods. This is the prime military standard which establishes uniform environmental test methods for determining the resistance of equipment to the effects of natural or induced environments, peculiar to military operations. Hermes cannot conduct testing for fungus and sand & dust, but arrangements can be made to have these carried out at other approved laboratories.

The manufacturing facility has a chemical process capability and the capability to manufacture printed circuit boards, plate, paint, weld, stamp, magnetically form and machine. The plant is equipped to manufacture electronic and mechanical components and equipment as prototypes or in quantity production.

The company's quality control and inspection department has developed and implemented a complete quality assurance program, which ensures quality and compliance to customers specifications, often to military standard. A calibration and standards room is maintained and supervised by quality control and inspection. This facility checks all company instruments to ensure their accuracy by using standards with certified values. These are traced to N.R.C. and N.B.S. and are checked at regular intervals to ensure their accuracy. A quality assurance manual in accordance with DND 1015 and with MIL-G-9858A defines the QA operations of the company.

EXPERIENCE: Hermes is a large scale producer of sonobuoys for the Canadian and US Governments, as well as other governments. They are presently completing a major order of AN/FPT-11 transmitters for the US Navy.

KEYWORDS: 5=Communications; 7=Electronics; 9=Environment;
19=Testing/Test Equipment; 20=Miscellaneous; HF Antennas=5;
Weather Stations=9; Sonobuoys=20; ASW=20; Beacons=5;
Environmental Laboratory=19; PC Boards=7.

REVISED: May 82.

COMPANY: HEROUX Inc

CODE: HER

ADDRESS: 755 Thurber
Longueuil, Quebec, Canada J4H 3N1

CONTACT: Mr. Robert Miles, Marketing Mgr - (514) 679-5450

HISTORY: Heroux Inc was founded in 1942 and is a wholly owned division of Bombardier Inc.

CAPABILITY: Heroux is a fully integrated company involved in the manufacture, assembly and the testing of aircraft landing gears and hydraulic systems for the military and commercial markets. They also operate a landing gear and hydraulic repair and overhaul facility in St Jean, Quebec. This latter R&O facility handles such aircraft as the 707, 727, 737, DC8, DC9, DC10, L-1011, C130, KC135, P3 and the DHC-5 & DHC-6. They have complete onsite electroplating facilities.

AVERAGE WORK FORCE: Total - 400

GROSS SALES: \$15M/Year

PLANT SIZE: 250,000 sq ft

EQUIPMENT: All necessary equipment for the manufacture, repair and testing of landing gear and hydraulic systems.

EXPERIENCE: The company is involved in all major markets in North America, England, Europe and South America on both military and commercial basis. Major customers include the US Air Force, Canadian Forces, Air Canada, Canadair, DeHavilland, McDonnell Douglas, Boeing, Lockheed, Grumman and other airlines (British Coledonian, Britannia, Avianca and Aero Peru).

KEYWORDS: 1=Aircraft; Hydraulics=1; Landing Gears=1; Repair & Overhaul=1.

REVISED: Jun 82.

COMPANY: HITECH CANADA Ltd

CODE: HIT

ADDRESS: HiTech Canada Building
Fifth Floor
1390 Prince of Wales Drive
Ottawa, Ontario, Canada K2C 3N6

CONTACT: Mr. James E Saarinen, Market Development Mgr - (613) 226-7800

HISTORY: HiTech is a privately owned Canadian company with all divisions located in the Ottawa area. The company received Federal incorporation in 1973.

CAPABILITY: Since incorporation, HiTech has been applying engineering and computer science skills to the development of computer systems; radar and tracking simulations; signal processing systems; and data entry and communication products. They have experience in space communications, air traffic control, surface radars, command control systems, real-time computer control systems, data compression systems, and electronic mail.

HiTech has the resources to support micro, mini and medium scale computers from a variety of vendors, such as Digital Equipment Corporation, Hewlett Packard, Intel, Motorola and Tandem. Their experience also extends to numerous peripherals such as printers, plotters, alpha numeric and graphic CRT's, mass storage mediums, data sensors and metering/monitoring equipment. Systems development can be accomplished in HiTech's own computer laboratory or at the customer's site.

In addition to providing consulting services and custom computer systems, HiTech is manufacturing the first of a family of products - the Imager 1000, an optical character recognition (OCR) page reader. This product evolved from internally funded research and development of image processing software. The Imager 1000 digitizes textual and graphical information. A software driven micro processor transforms text information to computer code (e.g., ASCII characters) and graphic information is highly compressed. The Imager 1000 has been designed as data entry device for data and word processing applications.

AVERAGE WORK FORCE: Professionals - 50 (1981)
Forecast - 75 (1982)

GROSS SALES: 1981 - \$2M (Approx)
1982 - \$3M (Forecast)

PLANT SIZE: 7,000 sq ft (existing offices and engineering)
1,000 sq ft (existing computer room and lab)
5,000 sq ft (planned manufacturing)

EQUIPMENT: Digital Equipment Corporation
Qty 3 - PDP 11 mini computers
Qty 6 - VT 100 video display terminals
Qty 2 - matrix printers
Qty 1 - letter quality daisy wheel printer

EXPERIENCE: Department of National Defense - various computer simulations

for radar, communications and electronic warfare systems; and data base configuration management systems for weapons systems managers. Department of Communications - real time control, data acquisition and data processing systems for environmental chambers used in pretesting satellites and components, e.g., Remote Manipulator Arm for Space Shuttle. Department of Transportation - various Air Traffic Control (ATC) studies and computer simulation of ATC radar. Bell Canada - Network Management System which is responsible for the collection, management and processing of alarms generated by their digital networks.

KEYWORDS: 5=Communications; 6=Computers; 15=Radar; 18=Space Systems; 19=Testing/Test Equipment; Computer Systems=6, 15, 19; Real Time=6; Control Systems=6, 19; Data Acquisition Systems=18, 19; Data Base Systems=6; Radar System Engineering=15; Computer Simulation=5, 6, 15, 18; Signal Processing=19; Tracking=15; Air Traffic Control Systems=6, 19.

REVISED: Jun 82.

COMPANY: I. M. P. GROUP Ltd

CODE: IMP

ADDRESS: Head Office
7037 Mumford Road
Halifax, Nova Scotia, Canada B3L 2J1

CONTACT: Mr. H L Connor, Marketing Director - (902) 469-0222

HISTORY: The company, Industrial Marine Products, was formed in 1967 to purchase the assets of a group of Nova Scotia companies which had been manufacturing foundry and steel fabricated products since 1865. During the next few years, they expanded into the commercial fishing gear and marine equipment areas, and expanded operations into other locations in eastern Canada and the US. In the early 1970s, the company acquired the facilities, equipment, operational management and work force of a major aircraft company in the Halifax area, and thus, expanded into aircraft overhaul and repair, and aerospace manufacturing areas. The current operating divisions of IMP Group are:

Aerospace Manufacturing	Tool and Plastics
Aerospace Engineering Services	Marine
Aircraft Repair and Overhaul	Offshore Services
General Aviation Services	Hotel
Foundry	Properties and Investments
Steel Fabrication & Machine Shop	Research and Development

CAPABILITY: IMP Group's capabilities are described in the eight divisions listed below:

Aerospace Manufacturing Division - manufactures electronic wiring assemblies for various aircraft and electronics industries. Aerospace metal components are also manufactured.

Aerospace Engineering Services Division - offers integrated services for the other aerospace divisions that include repair schemes, corrosion control, weight and balance, modification development, systems installation design, aeronautical engineering, aircraft maintenance, stress analyses, fatigue studies, structural design, electrical and avionics engineering, systems interface design, electromagnetic compatibility testing, systems ground and flight testing, configuration and modification program control, and maintenance and technical publications for military aircraft.

Aircraft Repair and Overhaul Division - as the major fixed and rotary wing maintenance facility in eastern Canada, it offers repair and overhaul programs for military and commercial aircraft, as well as a full range of equipment modification.

General Aviation Services Division - offers aircraft servicing maintenance, hangarage, crew and passenger lounges for large and small commercial aircraft.

Foundry Division - equipped to produce cast iron, steel and steel alloy castings up to 2-tons with both cupola and electric induction furnaces.

Steel Fabrication and Machine Shop Division - essentially a custom shop, it is serviced by four 5-ton overhead cranes. Typical products include components for fishing trawlers from steel, stainless steel and aluminum, and a whole range of products, repairs and modifications for offshore oil industry.

Tool and Plastics Division - manufactures molded plastic parts using the injection molding technique.

Research and Development Division - the primary function is to identify and develop new products and processes related to the continued expansion of the IMP Group and the technical excellence of its products.

Other Divisions of IMP Group have no apparent relevance to USAF requirements and are therefore, not further defined in this section.

AVERAGE WORK FORCE: No Data

GROSS SALES: IMP Group Ltd - \$50M
Aerospace Manufacturing Div - \$2.5M
Aerospace Repair & Overhaul Div - \$3.0M

PLANT SIZE: Aircraft Repair & Overhaul Div - 60,000 sq ft (2 hangars)
Steel Fabrication & Machine Shop - 14,000 sq ft
No data on other facilities

EXPERIENCE: IMP Group's aerospace clients include the US Navy (P3 aircraft), Canadian Department of National Defense, Canadair, USAF, and McDonnell Douglas Canada. They are hopeful of participating in the CF-18 Program.

KEYWORDS: 1=Aircraft; 3=Avionics; 12=Machining; 17=Software Services; 19=Testing/Test Equipment; Airframe Components=1; Airframe Structures=1; Repair & Overhaul=1; Wiring & Tubing=1; Injection Molding=12; Precision Casting=12; Structural Analysis=17; General Testing=19; Non-Destructive Testing=19; System Testing=19; Corrosion Control=1; Electromagnetic Compatibility=3, 19; Systems Interface Design=3.

REVISED: May 82.

COMPANY: IMAPRO Inc

CODE: IMA

ADDRESS: Administrative Offices
Suite #308
1750 Courtwood Crescent
Ottawa, Ontario, Canada K2C 2B5

Head Office & Manufacturing
West Royalty Industrial Park
Charlottetown, Prince Edward Island, Canada C1E 1B0

Marketing
215 Lakeshore Blvd East
Toronto, Ontario, Canada M5A 3W9

CONTACT: Mr. R L Appleton, Marketing VP - (416) 368-6358

HISTORY: The company was incorporated under Federal Charter in 1976 and has been operating since. The company is privately owned and is Canadian controlled. In April 1982, Matrix Corporation - a public US company listed on the American Stock Exchange, purchased a 30% equity position within Imapro Inc.

CAPABILITY: Imapro is a small, high technology company with unique expertise in the combined disciplines of optics, mechanics and electronics. Imapro's products are computer peripherals that produce hard copy photographic output (pictures) from digital data. Two technologies have evolved - CIR[™] (laser based) and QCR[™] (CRT based), both of which offer advanced capabilities.

The Color Image Recorder (CIR[™]) simultaneously records the three primary colors, in proper proportion, in a single pass of digital data. It can create color pictures from satellite generated imagery data (i.e., Landsat) or from any other suitably formatted source (i.e., medical diagnostic scanner). Resulting photographs have an extremely high resolution, and the time involved to produce a single photograph is normally one-third that required by competitive units. One version utilizes 240 mm-wide roll film, which makes the technique appropriate to a production line operation. This device uses fiber optic technology and a unique mechanical method for moving the film. Additional film formats are available.

The Quick Color Recorder (QCR) is significantly less expensive and represents the company's first volume manufactured product. It also operates as a computer peripheral, but requires three passes of digital data representing the Red, Green and Blue primary colors. Resolution is 2K x 2K with 4K x 4K available in the future. A variety of film format (i.e., 8" x 10", 4" x 5", or 35 mm) are, or will be supported. Manufacturing rights to this technology and distribution rights outside of Canada have been "rented" on an exclusive basis to New Jersey based Matrix Corporation. In addition, Matrix has placed a volume purchase contract with Imapro to supply the QCR product line for export, through Matrix to world markets. The purchase contract is a multi-year agreement, and rationalizes Canadian production in both the short and long term. Even when US manufacturing is established, the Canadian facility will continue to supply a substantial portion of total worldwide demand.

Imapro has also designed and installed in their plant, a distributed microcomputer system interconnected by fiber optics (1 Km runs). Expertise in the area of fiber optics is appropriate to systems as opposed to individual components. The company has considerable expertise in "graphics" and "image processing" and has developed general purpose data acquisition systems. Experience with microprocessors, both hardware implementation and software development, is a common thread to all technologies.

Research and development is an on-going priority and the company has particular interest in special projects that involve the combined disciplines of optics, mechanics and electronics.

AVERAGE WORK FORCE: Engineers - 10
Others - 10
(Expected to double over the next 12 months)

GROSS SALES: 1982/1983 - \$2.0M (Est)

PLANT SIZE: Charlottetown - 5,500 sq ft
Ottawa - 1,000 sq ft

EQUIPMENT: The Charolettetown facility incorporates a powerful 32-bit minicomputer with one megabyte of main memory and photo imaging capability. Disk and magnetic tape and off-line storage are supported. Significant capability also exists in the area of microprocessor software development, for example, in-circuit emulation. A computer aided design capability is planned for FY 82-83, in order to facilitate the design phase of the total production process. High precision measuring equipment exists in both the optical and mechanical areas.

A second 32-bit computer facility, with imaging capability is planned for Ottawa FY 82-83.

EXPERIENCE: Imapro clients include the Canada Center for Remote Sensing and Matrix Corporation. Project work has been undertaken for the National Research Council. Other clients include the Canadian Department of Communications and the Defense Research Establishment Ottawa.

KEYWORDS: 6=Computers; 7=Electronics; 10=Image Processing & Optics; 17=Software Services; 18=Space Systems; Image Processing=10; Film Recorders=10; Digitizing Scanners=10; Electro-Optics=10; Electro-Mechanics=7; Fiber Optics=10; Photographic Hard Copy=10; Landsat Imagery=10; Digital to Photo Processing=7, 10; Graphics/Display=17; Digital to Photo Data Reduction=18; Microprocessor Technology=6, 17.

REVISED: Jun 82.

COMPANY: INNOTECH AVIATION Ltd

CODE: INA

ADDRESS: Head Office
455 Michel Jasmin
Dorval, Quebec, Canada H9P 1C2

CONTACT: Mr. Douglas M McGregor, VP Marketing & Sales - (514) 636-4155

HISTORY: Innotech Aviation Ltd was incorporated in 1955 as Timmins Aviation Ltd. In 1967, the latter was acquired by Atlantic Aviation Corp of Wilmington, Delaware, resulting in a further name change to Atlantic Aviation of Canada Ltd. The present name came into being in 1974 when a group of the company's Canadian executives together with Innocan Investments Ltd purchased the shares held by Atlantic Aviation Corp. The company has offices and aircraft service facilities in six Canadian cities from coast to coast.

CAPABILITY: The current operating divisions of Innotech Aviation Ltd include - Engineering & Design; Aircraft Repair & Overhaul; Modification; Sky Services; Quality Assurance; Aircraft Sales and Brokerage; Charter Operations; and Aircraft Management Services. This profile describes the first five divisions:

Engineering & Design - This division offers a full range of aerospace related services which include repair schemes; corrosion control; weight and balance; systems installation design; aeronautical engineering; aircraft maintenance; modification development; structural design; electrical and avionics engineering; systems interface design; systems ground and flight testing; and custom designed aircraft interiors for commercial and military aircraft including air evacuation, hospital interiors, maintenance and technical publications for a wide range of commercial and military aircraft.

Aircraft Repair & Overhaul - This division's maintenance and service capabilities cover light single and twin engine aircraft, through to multi-engine turbo-props, turbo jets, and helicopters for civilian and military customers, as well as a full range of equipment modifications and non-destructive testing.

Modification - This division specializes in sheet metal work, aircraft welding, aircraft painting, cabinet making and upholstery of aircraft interiors and furnishings.

Sky Services - This division offers a full line of aircraft servicing, maintenance, hangarage, customs, weather facilities, briefing rooms, comfortable passenger and crew lounges, and flight lunches at six locations across Canada.

Quality Assurance - This division of Innotech holds the Canadian Ministry of Transport (MOT) and the Department of National Defense shop approvals. All aircraft inspectors are licensed by MOT.

AVERAGE WORK FORCE: Total - 490 (all locations)

GROSS SALES: No Data

PLANT SIZE: 450,000 sq ft (all locations)

EXPERIENCE: Innotech Aviation Ltd customers include the US Coast Guard (Falcon Aircraft), Canadian Department of National Defense (and other departments of the Canadian Government), Canadair, DeHavilland Aircraft of Canada, Falcon Jet, and many others.

KEYWORDS: 1=Aircraft; 3=Avionics; 7=Electronics; 12=Machining;
19=Testing/Test Equipment; Corrosion Control=1; Repair & Overhaul=1;
Weight & Balance=1; Systems Installation Design=1; Aeronautical Engineering=1;
Maintenance=1; Modification Design=1; Structural Design=1;
Electrical Engineering=1, 7; Avionics Engineering=1, 3;
Systems Interface Design=1, 3; Systems Ground Testing=1, 3, 19;
Systems Flight Testing=1, 3, 19; Helicopter R&O=1; Non-Destructive Testing=1,
19; Sheet Metal Work=1, 12; Welding=1, 12; Painting=1.

REVISED: Aug 82.

COMPANY: INRAD INDUSTRIAL RESEARCH & DEVELOPMENT Ltd

CODE: INR

ADDRESS: 345 Higgins Ave
Winnipeg, Manitoba, Canada R3A 0V4

CONTACT: Mr. Edward A Speers, President - (204) 947-1740

HISTORY: Inrad is a wholly owned Canadian company incorporated in 1975. There are no other Canadian locations.

CAPABILITY: The Inrad group is interested in new product development, particularly in the plastics, petroleum, chemical engineering, agricultural and energy spheres. They are also in the commercial packaging business. Some of their products include - a study of rare earth magneto-strictive materials for underwater transducers; photocatalytic conversion of water to hydrogen; the development of a high voltage fluorescent light switch; a farm fertilizer generator; and work on a high temperature solar collector suitable for a national grid system and for central heating.

A new material, porous titania glass, is available in research quantities. This acts as a photocatalyst when exposed to sunlight in the production of hydrogen from water at NTP. This material can be doped as required. Based on this technology, a portable hydrogen "sniffer" has been developed. The resistance of the detector changes on exposure to as little as 0.05% hydrogen in air. This instrument serves as an alarm for use near hydrogen producers such as batteries, hydrogen furnaces, and fuel cells.

Other capabilities include precision machining and engraving, plastic fabrication (vacuum forming), custom packaging, and skin and blister packaging.

AVERAGE WORK FORCE:

PhDs	- 2
Engineer	- 1
Physicist	- 1
Chemist	- 1
Others	- 7/15

GROSS SALES: Annual - \$0.5M

PLANT SIZE: 18,000 sq ft

EXPERIENCE: Inrad has worked with the Canadian Department of National Defense, the National Research Council, Atomic Energy of Canada Ltd, universities, and with private industry. They currently have no sales to the US. They have been in contact with USAF primarily in the area of rare earth magnets.

KEYWORDS: 4=Chemistry; 7=Electronics; 8=Energy; 9=Environment; 12=Machining; 20=Miscellaneous; Rare Earth Magnets=4; Photocatalyst=4; Alternate Fuels Research=4; Geophysics=7; Environmental Sensors=7; Solid State Devices=7; Solar=8; Trace Gas Detection=9; Titania Glass=4; Porous Titania Glass=4; Hydrogen Production=4; Water/Hydrogen Conversion=4; Hydrogen=4, 9; Hazardous Gas Detection=4; Hazardous Gas Alarm System=9;

Hydrogen Gas Detection=9; Injection Molding=12; Precision Machining=12;
Precision Engraving=12; Custom Packaging=20; Blister Packaging=20.

REVISED: Aug 82.

COMPANY: IRVIN INDUSTRIES CANADA Ltd

CODE: IIC

ADDRESS: 479 Central Ave
Fort Erie, Ontario, Canada L2A 3T9

CONTACT: Mr. John Swanigan, President - (416) 871-6510

HISTORY: Irvin Industries was incorporated in Canada in 1925 and is a subsidiary of Irvin Industries Inc of New York. The parent company not only operates many facilities in the US and one in Canada, but also in the UK, Italy, and Sweden.

CAPABILITY: Irvin Industries produces personnel parachutes (back & seat-type for ejection seats, military search and rescue units, paratroopers & military freefall), precision opening release systems, aerial delivery systems, inflatable life support systems, and aircraft, automobile & industrial restraint systems. Irvin has also designed and manufactured special purpose parachutes including sophisticated recovery systems for supersonic jet transports; and multi-use high-reliability & patented deceleration systems for fighter aircraft.

Irvin's Production Department is equipped with more than 300 sewing machines capable of efficiently stitching the latest natural and man-made fabrics, tapes and webbings. Added to this are quality control test machines, cloth laying and cutting tables, grommet and eyelet machines, and jigs and fixtures to enable the company to produce highly dependable and durable life support equipment. A new facility, completed in 1976 accommodates the assembly, inspection, and customer servicing of the FF-2 "Hitefinder" Automatic Parachute Opening Device. This facility is environmentally-controlled and is equipped with modern environmental test chambers, jigs, fixtures, and inspection equipment to ensure the necessary accuracy, quality and reliability required by this very sensitive life-saving instrument.

Irvin's Quality Control Program has been designed to conform with the requirements of the Canadian Armed Forces standards as defined in DND Spec 1015, whose equivalent US Department of Defense standards are MIL-Q-9858 and MIL-I-45208. The quality audits conducted by independently assigned specialists, as well as full-time in-house quality assurance representatives assigned by the Department of National Defense, provides for the surveillance of Irvin's quality control program. Irvin Industries Canada Ltd has been listed by the military as an "approved" company since Dec 1938.

Irvin's Engineering Department is responsible for all projects from the proposal stage to production. This encompasses design, development, static testing, aerial & dynamic testing, drawing approval, preparation of procedures & specifications, and approval of the first-off specimen. Preliminary design work is facilitated by an in-house computer which is capable of simulating tests, thereby avoiding extensive trial & error testing. They also maintain Drafting and Customer Service/Product Support Departments.

Irvin' products include space vehicle recovery, drone recovery, missile recovery, deceleration (for high performance aircraft) systems, personnel parachute systems, special purpose parachutes - precision opening & release systems, air cargo delivery systems, and other miscellaneous items such as

harnesses, belts, protective clothing, special suits/clothing, life rafts, and survival kits.

AVERAGE WORK FORCE: Total - 100

GROSS SALES: 1979 - \$5.62M
1980 - \$5.13M
1981 - \$5.81M

PLANT SIZE: 36,000 sq ft

EXPERIENCE: Irvin's customers include the USAF (AIM Parachute Program - joint USAF/Canadian program and the deceleration parachute for the F-105), the Canadian DND, Canadair, DeHavilland, and many other off-shore customers (primarily military).

KEYWORDS: 1=Aircraft; 13=Missiles; 14=Protective Equipment; 18=Space Systems; 20=Miscellaneous; Air Delivery Systems=1; Personnel Survival Equipment=1, 14; Personnel Restraint Equipment=1, 14, 20; Parachutes=1, 14; Precision Opening Release Systems=1; Inflatable Life Support Systems=1, 14; Special Purpose Parachutes=1, 14; Recovery Systems=1, 13, 18; Deceleration Systems=1; Drone Recovery Systems=1; Harnesses=14; Belts=14; Protective Clothing=14; Survival Kits=14.

REVISED: Sep 82.

COMPANY: ITT CANNON ELECTRIC CANADA
(A Division of ITT Industries of Canada Ltd)

CODE: ITT

ADDRESS: 4 Cannon Court
Whilby, Ontario, Canada L1N 5V8

CONTACT: Mr. Bruce D Vallillee, Sales Representative - (416) 668-8881

HISTORY: The company commenced operation in Canada in 1942 as Cannon Electric Company Ltd. The parent company, Cannon Electric Company (Los Angeles), was eventually purchased by ITT Corporation and the Canadian company became a wholly owned ITT subsidiary. In 1956, the company name was changed to its present name, and in 1967 the company began operation as a Division of ITT Canada Ltd. The company maintains Sales Offices in Montreal and Vancouver.

CAPABILITY: ITT Cannon Electric Canada is engaged in R&D, manufacture, and sales of electrical & electric connectors, cable harnesses, and interconnect devices for the hostile environment market. Cannon connectors are in virtually every passenger jet aircraft in the free world, deep in the earth & ocean, in space, in nuclear reactors, and in oil & gas drilling rigs - in other words, in the hostile environment.

Their manufacturing capability features both manufacturing & industrial engineering, tool design (plastic & metallic components), machining fabrication & assembly operations, machine & model shops, molding facilities, and electroplating. They have world-wide market responsibility and engineering design cognizance over, a) battery power connectors, b) firewall connectors, c) waterproof connectors, d) high temperature connectors, e) buffet series, f) aircraft firewall connectors, g) circular nuclear series, h) weatherproof series, i) Canadian design specials, j) environmental rack & panel DRA series, k) Cable TV-CATV connectors, l) geophysical-seismic, m) cryogenic connector series, and n) sonar-underwater tow connectors.

Product development has led to a variety of new and/or improved connectors. These include, a) a new series with proven results at elevated temperatures for nuclear applications; b) a connector to meet MIL-C28840 for seaboard applications (submitted for QPL); c) a connector (MS5015/3400D series) being used by the US Navy on new equipment as well as for retrofit, replacement & all power applications; d) the MIL-C-83723 series III connector designed for high performance aero applications; e) the "Downhole" connector designed for high pressure usage (hermetically sealed); f) the MR series connector - rugged, heavy duty & waterproof (designed to withstand severe environmental conditions); g) a geophysical hermaphroditic connector designed for the seismic exploration industry; and h) a connector to meet MIL-C-38999.

AVERAGE WORK FORCE: Not Specified.

GROSS SALES: 1980 - \$18M
1981 - No Data
1982 - No Data

PLANT SIZE: Production - 55,000 sq ft
Office - 15,000 sq ft

EXPERIENCE: It suffices to say that Cannon connectors are designed to the specification of the electronic industry, and meet the requirements of the Canadian Department of National Defense, the US DOD, Canadian Ministry of Transport, and the Canadian Standards Association. Cannon plugs are used world-wide.

KEYWORDS: 1=Aircraft; 7=Electronics; 9=Environment; 20=Miscellaneous;
Connectors=1, 7, 9, 20; Tubing=1, 20; Wiring=1, 7, 20; Cable=1, 7, 20;
Harnesses=1, 7, 20.

REVISED: Mar 82.

COMPANY: IVI Inc

CODE: IVI

ADDRESS: P. O. Box 790
Courcelette, Quebec, Canada G0A 1R0

CONTACT: Mr. Thomas Tessier, Marketing Administrator - (418) 844-3711

HISTORY: IVI Inc (Valcartier) carries on a tradition in the manufacture of small arms ammunition that dates back to 1880 when the Quebec Arsenals were established in the walls of the city. It was incorporated as Valcartier Industries Inc in 1966, later changed to IVI Inc, and is located on a 500 acre site at Val Belair, Quebec, 15 miles outside of Quebec City. A second plant, located within the city, produces heavy artillery cases. IVI Inc, a wholly owned subsidiary of the SNC Group, is Canadian owned.

CAPABILITY: IVI Inc is a manufacturer of high quality, small arms ammunition, both military and commercial, and large caliber cartridge cases. It is the only Canadian small arms ammunition manufacturer and supplier to the Canadian Forces. They operate their own foundry and produce brass, lead and gilding metals required for the manufacture of ammunition. Valcartier ammunition conforms to NATO specifications. Their plant is equipped with its own water wells, water treatment plant and industrial waste treatment plant.

They manufacture various small arms ammunition such as the NATO 7.62mm round. All dies, punches, tool holders and other tools are produced in-house. The precision tooling is used for both sporting and military small arms ammunition, as well as for all artillery ammunition in the 40mm to 4-inch naval shell range. The casings for the various calibers, including 105mm tank gun cases and field artillery cases, are produced in their Louise Basin manufacturing facility in Quebec City.

IVI maintains high quality control standards through rigid and numerous destructive and non-destructive inspection checks following the various stages in the manufacturing process. For example, during the production of the 7.62mm round, there are fifteen separate inspections, beginning with a test for impurities in the base metals after melting, right on through to a final inspection before packaging the finished rounds. They have a functioning Proof House and ranges for proof firing of all products

They have recently started an R&D department whose aim is to improve present products and techniques and to provide ammunition research facilities capable of responding to military requirements. The department is equipped with a manufacturing capability, testing facilities, measuring devices and indoor and outdoor ranges.

AVERAGE WORK FORCE: 1,000 +

GROSS SALES: Annual - \$45M

PLANT SIZE: Manufacturing - 500,000 sq ft
Warehouse - 84,000 sq ft
Total Acreage - 500

EXPERIENCE: IVI is the sole supplier of small arms ammunition and large caliber brass cases to the Canadian Forces. They export small arms ammuni-

tion to more than 20 countries, including the US, Norway, Belgium, Kenya and Indonesia. They are currently participating in the Advance Attack Helicopter project (US Army). They are the main source of 30mm aluminum cartridge cases. These cartridge cases are supplied to the Defense Systems Division of Honeywell, who in turn subcontracts them to Hughes Helicopter.

KEYWORDS: 2=Armament; 19=Testing/Test Equipment; Ordnance=2; Ammunition=2; Small Caliber=2; Large Caliber Casings=2; Research=2; Manufacturing=2; Testing Ranges=2, 19.

REVISED: Feb 82.

COMPANY: JATEL COMMUNICATIONS SYSTEMS LTD

CODE: JAT

ADDRESS: 39 Leacock Way
Kanata, Ontario, Canada K2K 1T1

CONTACT: Mr. J Ebrahimi, President - (613) 592-4331

HISTORY: Jatel Communications Systems Ltd was founded in 1976 and is 100% Canadian owned.

CAPABILITY: Jatel activities include consulting, systems studies, and applied research associated with telecommunications techniques. As a result of successful endeavors in the aforementioned, they initiated and brought to fruition, a research and development program that resulted in the development and production of their RX-32 Communication Switching System. This system is scheduled to undergo field trials with the Canadian Department of National Defense for air traffic control applications. The RX-32 system is a solid state, time division multiplex switching network. It has a stored program and is microprocessor controlled.

Jatel areas of scientific specialization include design and manufacture of customized telecommunications systems for both civilian and military applications. Typical applications include air traffic control communications, Coast Guard Ship-to-Shore communications and police radio dispatch communication systems.

AVERAGE WORK FORCE: Professionals - 8

GROSS SALES: 1981 - \$500,000 +

PLANT SIZE: 1,500 sq ft

EXPERIENCE: Jatel customers include the Canadian Department of National Defense.

KEYWORDS: 5=Communications; 7=Electronics; Switching=5, 7; Telephone=5, 7; Radio=5, 7; Solid State Devices=5, 7; Consulting=5, 7; Research and Development=5, 7; Air Traffic Control Communications System=5.

REVISED: Jan 82.

COMPANY: JMR INSTRUMENTS CANADA Ltd

CODE: JMR

ADDRESS: No 8, 6320 11th St, S E
Calgary, Alberta, Canada T2H 2L7

CONTACT: Mr. G I McMillan, Marketing Representative - (403) 255-6667

HISTORY: JMR was incorporated in the fall of 1978 and is totally owned by JMR Instruments Inc, Chatsworth, CA. The latter company in turn is a subsidiary of Bowmar Instruments Corp, Newberry Park, CA.

CAPABILITY: JMR Instruments is a high technology electronics designer and manufacturer of satellite doppler survey receivers, and integrated marine navigation & data acquisition systems. These integrated systems use distributed microprocessor technology, KALMAN filtering, and "fail-soft" hardware. Equipment is designed and field-proven to meet rigid commercial field and marine conditions.

AVERAGE WORK FORCE:

Engineers	- 5
Computer Specialists	- 6
Others	- 13

GROSS SALES: 1980 - \$1.1M
1981 - \$2.2M

PLANT SIZE:

R&D Area	- 1,000 sq ft
Manufacturing Area	- 1,800 sq ft
Admin Area	- 1,500 sq ft

EQUIPMENT: JMR maintains specialized microprocessor design and development systems including PDP11-34 and PDP-1144, with RSX11M operating systems. They also have a full range temperature and environmental chamber.

EXPERIENCE: JMR satellite doppler receivers manufactured in Canada are in use throughout the world. Users include the Canadian Military (Mapping and Charting Establishment), the Canadian Hydrographic Service, and many commercial users. Their marine products are used by the Defense Research Establishments (Ottawa & Pacific), and many commercial customers. The Pakistan Navy is using their fully integrated navigation system.

KEYWORDS: 7=Electronics; 18=Space Systems; 20=Miscellaneous;
Ground Positioning=7, 18; Doppler Survey Receivers=7, 18;
Integrated Marine Navigation Systems=7; Integrated Data Acquisition Systems=7, 20; Navigation=7, 18; Data Acquisition=7, 20.

REVISED: Sep 82.

COMPANY: KOSS MACHINE & TOOL CO

CODE: KOS

ADDRESS: 1765 Shawson Dr, Units 7 & 8
Mississauga, Ontario, Canada L4W 1N8

CONTACT: Mr. Dragomir Cajic, President - (416) 678-7236

HISTORY: Koss Machine & Tool Co was started in 1975 as a general machine shop and incorporated in 1976. The company ventured into defense and aircraft industry associated work in 1978 which today comprises 80% of their work. The company is a division of 333 111 Ontario Ltd.

CAPABILITY: Koss Machine is involved in milling and lathe operations primarily involved with defense and aerospace related work. The CNC milling operation has a working travel of up to 20x40 inches and a vertical space up to 29.75 inches. Tolerances can be held to 0.0003 inch. A new Makino machine center is operational. It exhibits X, Y, Z axis lengths of 75.5, 27.5, and 23.6 inches, respectively.

Lathe operations are carried out with both CNC and conventional machines with maximum swing of 24 inches, maximum cross travel of 9.75 inches, and a maximum machining length of 21.5 inches. A quality assurance manual (quality level to DND 1016/MIL-I-45208) has been prepared.

<u>AVERAGE WORK FORCE:</u>	Machinists	- 10
	Quality Control	- 1
	Production Control	- 1
	Administrative	- 2

GROSS SALES: 1979 - \$0.120M
1980 - \$0.270M
1981 - \$0.265M (first 6 months)
1982 - \$0.750M (projected)

PLANT SIZE: 6,000 sq ft

EQUIPMENT: Koss' equipment includes CNC machines, vertical milling machines, engine lathes, turret lathes, and other assorted equipment associated with machining operations.

EXPERIENCE: Contractor approvals have been afforded by Canadair Ltd, the DeHavilland Aircraft of Canada Ltd, and McDonnell Douglas.

KEYWORDS: 12=Machining; Precision Machining=12; Tooling=12;
Injection Molding Tools=12.

REVISED: Sep 82.

COMPANY: LEIGH INSTRUMENTS Ltd
(Engineering & Aerospace Division)

CODE: LEI

ADDRESS: 2680 Queensview Dr
Ottawa, Ontario, Canada K2B 8J9

CONTACT: Mr. Bruce Algee, Marketing Mgr, Military Systems - (613) 820-9720,
X336

HISTORY: Leigh Instruments Ltd is a publicly-owned Canadian Corporation engaged in the development and the manufacture of electronic equipment and systems for international, military and commercial markets. Incorporated in 1961, Leigh has been one of Canada's fastest-growing, high-technology companies in the last two decades. Sales have increased from \$100,000 per annum in 1962 to \$48 million for fiscal year 1981.

The company now manufactures a broad line of avionics and has developed extensive experience in the supply of major systems for government, military and transport departments, both in Canada and abroad.

Leigh over the past fifteen years has developed and demonstrated a complete capability as a system oriented contractor in the management of major electronic programs. Many of these have involved the supply of complex electronic systems on a turnkey basis. Leigh has been responsible for program management, system integration, sub-contract administration, sub-system and component manufacture, complete documentation and installation and support.

The Leigh QA department currently conforms to the requirements of DND 1015, which incorporates MIL Q 9585B.

The Engineering and Aerospace Division is discussed under capability below. Other Canadian Divisions are the Industrial Products Division (Waterloo, Ontario) and the Frequency Control Division (Toronto, Ontario). They have subsidiaries in Syracuse, New York and the UK. The Industrial Products Division is a producer of commercial electromechanical devices that include teletypes, teleprinters, explosive detectors and automated postal systems. The Toronto Division designs and manufactures quartz crystals, filters and synthesizers for radio communication and navigational equipment. Leigh Systems Inc (Syracuse) manufactures industrial packaging equipment and process control instrumentation. Navigation Systems Group in Montreal design, manufacture and install fixed/mobile control towers and a mil spec, Tacan, solid-state beacon designated AN/URN-26.

CAPABILITY: The Engineering and Aerospace Division is committed to the design and development of avionics equipment for both commercial and military aircraft. Specialized equipment, generally categorized as aircraft instrumentation and electronic data processing/acquisition systems, include deployable Crash Position Indicators/flight data recorders, altimeters, mechanical strain recorders, instrument panels and a variety of special sensors and signal processing equipment. The division is a system integrator of radar traffic management for both air and marine systems. The company also manufactures an ice detector that has application on rotary and fixed-wing aircraft, hovercraft, low-speed ground vehicles, and stationary gas turbines. The Leigh Ice Detector System is especially well suited for helicopter use in

that it does not require a given amount of air flow around the fuselage to yield a signal on the detector.

A Real-time Photogrammetry System, originally conceived by the Canadian National Research Council to assist tracking a moving object in 3-dimensional space, employs state-of-the-art photogrammetry techniques to continuously determine and display with high precision, position and orientation of the tracked object. The system has just been successfully demonstrated to NASA at its Remote Manipulator Development Facility at the Johnson Space Center. NASA is studying the effectiveness of the system integrated with the Remote Manipulator System to assist Space Shuttle crew in space manipulations of payloads.

All of the division's products were developed and qualified in-house to customer specifications. Of particular interest, the company was recently awarded a major contract to develop and deliver a Service Test Model shipboard integrated interior communications system.

In summary, the company possesses the capability to design, develop, qualify and produce modern military electronics. Taken all of the above in combination, Leigh can analyze complex requirements, translate these requirements to sub-system building blocks, and then integrate these sub-systems into the next tier of a major weapon system.

<u>AVERAGE WORK FORCE:</u>	Engineers	-	50
	Technologists	-	75
	Machinists	-	20
	Assemblers	-	150

<u>GROSS SALES:</u>	1979 - \$10.7M
	1980 - \$20.2M
	1981 - \$24.3M

PLANT SIZE: 122,000 sq ft (Ottawa & Carleton Place, Ontario)

EQUIPMENT: Complete line of avionics production line automatic test equipment, environmental test and burn-in facilities.

EXPERIENCE: Leigh Instruments Ltd's major customers include; US Navy, US Army, US Air Force, US Coast Guard, Canadian Forces, Canadian Coast Guard, Transport Canada, McDonnell-Douglas, Lockheed, Boeing, RAF, FRG DOD, Panavia. Source qualified by all of the foregoing.

Leigh Instruments Ltd's major projects include:

Transport Canada	Vessel Traffic Management Systems	\$10.0M
Dept of National Defense	Terminal Radar Control System	\$17.0M
Dept of National Defense	SHINCOM (R&D)	\$ 6.0M
Panavia	Cockpit Voice Recorder	\$ 3.0M

Panavia

Crash Position Indicator/Flight Data Recorder \$ 6.0M

US Navy

AN/ASH-20 CPI/FDR System.

KEYWORDS: 1=Aircraft; 3=Avionics; 5=Communications; 15=Radar;
16=Security & Safety; Airfoil=1, 3, 16; Beacon=1, 3, 16; Data Acquisition=16;
Data Processing=16; Traffic Management=15; Ice Detector=3, 16;
Crash Position Indicator=3, 16; Intercom=5; Design=3, 5, 15, 16;
Development=3, 5, 15, 16; Manufacture=3, 5, 15, 16; Repair & Overhaul=3;
Flight Data Recorders=1, 3.

REVISED: Mar 82.

COMPANY: LITTON SYSTEMS CANADA Ltd

CODE: LSL

ADDRESS: 25 Cityview Drive
Rexdale, Ontario, Canada M9W 5A7

CONTACT: Mr. B A Bisley, Dir of Marketing - (416) 249-1231

HISTORY: Litton Systems Canada Ltd (LSL) is a wholly owned Canadian subsidiary of Litton Industries based in Beverly Hills, California. The company was established in 1960 with the purpose of assembling and testing the Inertial Navigation System for the CF-104 Starfighter Program. In 1962, the company's facilities were expanded to include "clean" and "superclean" assembly and test areas for the building of gyroscopes, accelerometers and gimbal platforms. To date, more than 5900 inertial systems have been produced at LSL for implementation in commercial and military aircraft. More recently, LSL was selected as second source supplier for inertial systems to the US Cruise Missile Program. The company has now been approved to Naval Weapons Center (China Lake) missile standards and is producing systems in quantity.

CAPABILITY: The newest generation of LSL inertial systems employs Ring Laser Gyro (RLG) technology in a strapdown configuration. Airbus Industries has recently selected this inertial reference system - the LTN-90, for their A310 aircraft. LSL will manufacture and assemble these RLG systems at their Rexdale facility.

Since 1962, Litton built inertial systems have been supported by an automatic test capability developed at LSL and in use world-wide by both commercial and military facilities. In 1980, LSL established a Digital Automatic Test Program Generation facility utilizing LASAR software hosted on a DEC VAX 11/780 computer system. This system is capable of automatically and efficiently generating thorough, accurate, low cost test procedures which can be converted into test program sets meeting any ATE requirements.

Litton Systems has also recently been selected the second source supplier of Head-Up and Multi-Function Displays to the F-18 Program. These cockpit displays will be manufactured and assembled at their Rexdale facilities.

This extensive inertial background has led to the development of the Inertial Referenced Flight Inspection System (IRFIS) which is capable of calibrating Category I, II and III instrument landing systems as well as enroute nav aids. The modular design approach, spare memory and computing time capability, provide exceptional flexibility in system design, thereby permitting the system to be modified to meet new or special requirements.

In 1972, Litton entered the airborne search radar field with a system for the CH-124 Sea King helicopter. Since that time, significant improvements in radar technology have been made and Litton's newest system exploits modern computer and microcircuit techniques. TV-type raster displays, video recording capabilities and digital signal processing all enhance this radar's performance.

From this primarily inertial base, LSL developed and refined its expertise to create a unique systems engineering capability. In 1967, a prime contract was awarded to design and manufacture a command and control system for the

Canadian DDH-280 class destroyers. This contract heightened the company's ability in systems engineering, software and display capabilities for simulation programs.

The valuable experience in shipborne communications gained from this contract assisted LSL to a great extent in their recent design of the Automatic Data Link Plotting System (ADLIPS). This computer-assisted control and tactical communications system collects and processes data from ships' sensors and displays the same composite tactical picture in each ship equipped with ADLIPS. In NATO applications, ADLIPS utilizes a Link-11 capability for primary tactical exchange. The system's flexibility and modular design enables it to be configured to meet particular customer system applications, whether this be as a retrofit system or for installation in new ships.

This capacity for unique Systems Engineering facilitated the design and development of Litton Integrated Security Systems. These computer-based systems combine complete perimeter detection, surveillance, access control and radio communications systems to provide the level of protection necessary. The company has obtained contracts for these systems for implementation in Maximum Security Penitentiaries and Nuclear Power Generating Stations.

LSL has also designed digital radar simulators for training civil air traffic controllers, ground control interception officers for the Air Force, air navigators and naval officers in marine navigation and naval tactics. These simulators have been designed in modular form both in hardware and software resulting in several models and configurations in various training applications. Both single and dual radar simulators have been developed with realistic simulation of aircraft and surface vessels and with variable radar characteristics and video effects including clutter, moving weather and land mass.

Under the US/Canada Defense Production and Development Sharing Program, Litton Systems has developed a solid state, flat panel display system using light emitting diode technology for use in military environments. The Multi Mode Matrix Display system provides a sunlight readable, flat panel display with high reliability, degraded mode capability, fast speed of response, and large growth potential. The system comprises a data bus interface, computer, display generator and an LED flat panel display head. It is in the area of the display head that the major advances in technology have been made. The display head measures approximately two inches in depth and is constructed of fully abutable modules. Each has a LED display surface measuring one inch square with a resolution of 64 LEDs/inch or 4096 LEDs/module. The modular design concept provides flexibility of display size. Current developments of the displays include color and video capability.

The large scale system integration capability is further demonstrated by the Data Interpretation and Analysis Center (DIAC) developed for the Canadian Forces Maritime Command. This computerized system is used for correlating current and historical data and enhances mission planning, briefing, debriefing, and post-flight reconstruction and analysis.

In addition, Litton Systems has provided scientific support services to the Department of National Defense in the form of weapons systems computer modelling to stimulate combat systems, tactical scenarios, and associated physical phenomena.

AVERAGE WORK FORCE: Engineers - 500
Mfg/Admin/Techs - 2,000

GROSS SALES: 1979 - \$74M
1980 - \$105M
1981 - \$121M

PLANT SIZE: 460,000 sq ft

KEYWORDS: 1=Aircraft; 3=Avionics; 5=Communications; 7=Electronics; 15=Radar;
16=Security & Safety; 17=Software Services; 19=Testing/Test Equipment;
20=Miscellaneous; Cockpit Displays=3; Data Analysis=3, 7; Instruments=1, 3;
Inertial Navigation=3, 7; Simulators=15; Training=3, 15, 20; C3 Systems=5;
Data Acquisition=7, 17; LED Displays=7; Repair and Overhaul=3; Solid State
Devices=7; Data Processing=3, 7, 17; Simulation Programs=17; Intrusion
Detection=16; Instrumentation=19; Air Traffic Control Systems=20; Air Traffic
Control Simulators=20; Navigation=3, 7.

REVISED: Mar 82.

COMPANY: LUMONICS Inc

CODE: LUM

ADDRESS: 105 Schneider Road
Kanata, Ontario, Canada K2K 1Y3

CONTACT: Mr. Roger Sandwell, Sales Manger, Research Products - (613) 592-1460

HISTORY: Lumonics Inc is a Canadian owned high technology company incorporated in 1970 with one subsidiary in the US. The company also has a subsidiary in the UK - JK Lasers - that specializes in a range of Nd:YAG and Ruby Lasers for general purpose research applications including holography. The company was formed to manufacture and sell the pulsed CO2 lasers developed at the Defense Research Establishment Valcartier.

CAPABILITY: Lumonics specializes in pulsed gas lasers and is the sixth largest North American laser manufacturer serving both the scientific and industrial markets. They have twelve series of lasers available with various models within each series. A significant portion of their business is contract R&D, but it is carried out only when Lumonics anticipates and retains rights for commercial exploitation. Their scientific market includes university and government researchers. The two primary fields in which their customers are active are chemistry/isotope separation, and controlled thermonuclear fusion. Lumonics has also been manufacturing a series of excimer lasers for scientific application since 1978, and has just received Government funding to develop an industrial series over the next 4.5 years.

Lumonics' key functions of material procurement and control, electrical and mechanical assembly, and final preference testing are carried out in-house. Machined and sheet metal components are sub-contracted.

AVERAGE WORK FORCE: Scientists & Engineers - 40
Others - 100

GROSS SALES: 1978/79 - \$ 4 - 5.9M
1981 - \$ 7M
1982 - \$11M (with JK Lasers, approx \$15M)

PLANT SIZE: 50,000 sq ft

EXPERIENCE: Lumonics is interested in working with the USAF and has done so in the past in the form of providing standard lasers. They have not undertaken any USAF-sponsored R&D. They carry out extensive in-house R&D for the Canadian Government.

KEYWORDS: 11=Lasers; Pulsed Gas Lasers=11; Excimer Lasers=11; Gas Lasers=11; Lasers=11; CO2 Lasers=11.

REVISED: Sep 82.

COMPANY: MACDONALD DETTWILER & ASSOCIATES Ltd

CODE: MDA

ADDRESS: 3751 Shell Road
Richmond, British Columbia, Canada V6X 2Z9

CONTACT: Dr Marshall N Prentice, Sales Manager - (604) 278-3411

HISTORY: MDA is a privately owned Canadian company formed in 1969 with a single plant in Vancouver, BC.

CAPABILITY: MDA is a leading supplier of digital systems in the fields of remote sensing from air and space, data handling from meteorological satellites, and airline flight operations. It is a high technology firm whose main areas of business are; (1) remote sensing satellite processing systems (especially for the NASA Landsat series), (2) meteorological satellite processing systems for all the major satellites (this area has recently been expanded to include full weather forecasting systems), (3) synthetic aperture radar (SAR) digital processors for airborne and spaceborne sensors, (4) aviation systems for flight operations support, and (5) high speed film image recorders.

MDA is a leading supplier of Earth Resource Satellite Stations. The company has played a role ranging from that of prime contractor providing a fully integrated receiving and processing facility, to that of subcontractor supplying system design and subsystem components. The basic design of these satellite data systems is modular. Data can be processed at high speed from a variety of sources including the MSS and TM sensors of the current Landsat satellite. In addition to radiometric and geometric corrections, the processing permits accurate resampling to map projections so that various data fields can be overlaid and thematic imagery in map-format produced.

MDA supplies complete ground stations for the reception and processing of data from polar orbiting and geostationary meteorological satellites. Their Weather Image Processor processes, stores, and images satellite data during reception. The user can play back stored data to produce enhanced images or video displays of specific areas of interest. They also produce an analysis system which permits extended interactive analysis of the meteorological satellite data, and provides for the overlay of conventional measured and forecast meteorological parameters on imagery to enhance its usefulness in forecasting.

MDA designs and manufactures digital processors for both airborne and spaceborne SARs. Their developmental designs are based on computer software and on high speed electronic hardware. This allows them to supply small fast units for aircraft use and larger ground based units for the processing of satellite generated radar data. The recently announced IRIS product is a complete airborne SAR system with dual frequency transmit and the capability of image storage, downlink, or real-time hard copy on the aircraft.

MDA's flight operations digital equipment is used by the commercial aviation industry. Their major project is a Flight Operations Computer System (FOCUS) which automatically plans all scheduled and charter flights for an airline. FOCUS can minimize fuel consumption by calculating the optimal flight path and flying altitude based on the forecast weather conditions. FOCUS files the

flight plan with the air traffic control authorities and in turn monitors the progress of the flight.

The MDA FIRE 240 laser film image recorder exhibits high resolution, high geometric accuracy and high throughput. It is rugged, light weight, and allows for unattended operation. A color version has been produced with similar high resolution and high speed.

<u>AVERAGE WORK FORCE:</u>	Elect Eng	-	60
	Data Processing	-	70
	Systems Engs	-	20
	Scientists	-	15
	Admin	-	75
	TOTAL	-	240

GROSS SALES: 1981 - \$14M
1982 - \$18M (growth rate 25% per year)
(50% exported outside North America)

PLANT SIZE: 69,613 sq ft

EQUIPMENT: MDA's equipment includes Digital Electronic Assembly & Test Facility; General Purpose Computer Facility; and Systems Integration Rooms.

EXPERIENCE: MDA had served as prime contractor on large scale systems for Swedish Space Corp, Australia, National Research Council (Thailand), Indonesian Space Agency, German Space Agency, European Space Agency, Swissair Transport Co Ltd, Texas International Airlines Inc, Canada Center for Remote Sensing, and Atmospheric Environment Service Canada. They have served as subcontractor to Bendix, TRW Systems, General Electric Co, Jet Propulsion Laboratories, NASA, Messerschmitt-Bolkow-Blohm (W Germany), National Space Development Agency of Japan, and Hitachi.

KEYWORDS: 1=Aircraft; 6=Computers; 7=Electronics; 9=Environment;
10=Image Processing & Optics; 11=Lasers; 15=Radar; 18=Space Systems;
Landsat=18; Image Processing=9, 10, 15, 18; SAR=1, 15, 18; Remote Sensing=1,
18; Image Recorder=1, 7, 10, 18; Flight Operations=1, 6; Digital=1, 7, 15, 18;
Ground Stations=18; Software Systems=1, 7, 15, 18; Data Handling=1, 10, 18;
Meteorological Satellite Processing Systems=9, 10, 18;
Weather Forecasting Systems=9, 18; Synthetic Aperture Radar=1, 15, 18;
Weather Image Processor=9, 10, 18; Interactive Analysis=9, 10, 18;
Laser Film Image Recorder=1, 7, 10, 11, 18.

REVISED: Oct 82.

COMPANY: E. S. MANTIS RESEARCH CORP

CODE: ESM

ADDRESS: 708 Copping St
North Vancouver, British Columbia, Canada V7M 3G6

CONTACT: Mr. E Sitnam, President - (604) 929-5245

HISTORY: A Canadian owned company, incorporated in April 1976.

CAPABILITY: E.S. Mantis Research Corp is engaged in the design, development and manufacture of solar collectors. They have developed a relatively small, light-weight collector that is touted as highly efficient. The unit produces working fluids up to 149°C (300°F) in a short time period without tracking the sun. The unit can readily be incorporated into systems for water and space heating, air conditioning, desalination, and generation of electricity.

AVERAGE WORK FORCE: Professionals - 4
Labor Force - 16

GROSS SALES: No Data

PLANT SIZE: 17,000 sq ft

EXPERIENCE: No Data

KEYWORDS: 8=Energy; Solar Collectors=8; Solar Systems=8.

REVISED: May 82.

COMPANY: MARS AERIAL REMOTE SENSING Ltd

CODE: MAR

ADDRESS: 640-11th Ave, S W
Calgary, Alberta, Canada T2R 0E2

CONTACT: Dr Frank G Bercha, President - (403) 262-8482

HISTORY: The company was incorporated in 1980 in Calgary, Alberta, and currently has a branch office in Ottawa, Ontario, and Phoenix, Arizona. The company is 100% Canadian owned. It is affiliated with F G Bercha and Associates Ltd, a Canadian consulting company.

CAPABILITY: The company specializes in providing an integrated remote-sensing service. It owns and operates a Gulfstream G-1 aircraft equipped with a side-looking airborne radar of the APS-94D type, as well as, an assortment of other sensors including RC-8 cameras, multispectral camera, thermal scanner, and magnetometer. The side-looking radar is of aerospace technology caliber, and includes both analog and digital output. It is capable of storing the digital output for subsequent digital interpretation. The hardware system is the only one of its type in the world; as such, MARS possesses a unique capability in terms of hardware. In addition, the MARS approach to integrated remote sensing, providing a useful information product, has made it well known for its capability in solving information related remote-sensing problems through judicious design, execution, interpretation, and analysis of remote-sensing program images.

AVERAGE WORK FORCE: Total - 20 (including executive, engineering staff, aircrew, mechanics, radar engineers, sensor technicians and support staff).

GROSS SALES: 1980 - \$3M (expect sales to increase substantially in 1981 and subsequent years).

PLANT SIZE: Office Space - 2,500 sq ft
Industrial Space - 3,000 sq ft
Additional space is leased for aircraft maintenance, electronic shops and general operations.

EQUIPMENT: Grumman G-1 aircraft with APS/94D SLAR, RC-8, I2S, magnetometer, and TIR scanner constitute a unique commercial multi-sensor package.

EXPERIENCE: The company has carried out work for most of the major US oil companies, including Exxon, ARCO, Amoco, Mobil, Chevron, Sohio, and Phillips, as well as selected projects for Burlington Northern and a number of mining companies. Its principal clients in Canada constitute the Federal Government, Dome Petroleum, Petro-Canada, and Gulf Canada Resources.

KEYWORDS: 8=Energy; 9=Environment; 20=Miscellaneous; Remote Sensing=8, 9; Airborne Surveys=8, 9, 20; Environmental Analysis=9; Mapping=8, 9, 20.

REVISED: May 82.

COMPANY: MENASCO CANADA Ltd

CODE: MCL

ADDRESS: 3495 Cote Vertu Road
St Laurent
Montreal, Quebec, Canada H4R 1R3

CONTACT: Mr. Paul A Rivard, Marketing Services Mgr - (514) 332-3330

HISTORY: Menasco is a wholly owned subsidiary of Menasco Inc and was organized in 1971.

CAPABILITY: Menasco designs, develops, test, and manufactures fixed-wing aircraft and helicopter landing gear systems. Also included in this capability are electro-hydraulic and hydro-mechanical systems related to primary and secondary flight controls; fly-by-wire electro-hydraulic flight controls; ground steering, including steer-by-wire; aircraft hydraulic systems; variable wing and wing sweep actuation and machining of aircraft and helicopter components. They meet contractor and quality control standards as specified by FAA, DOT, MIL-Q-9858A, NPC-200, and DND 1015. Physical and environmental testing is accomplished with, among other facilities, three drop test towers which can also measure landing gear shimmy and steering characteristics.

AVERAGE WORK FORCE:

Engineers	- 35
Manufacturing	- 448
Others	- 175

GROSS SALES: No Data

PLANT SIZE: 208,000 sq ft

EQUIPMENT: Complete physical and environmental testing laboratory for landing gear, flight controls and actuating devices, including facilities for vibration, structural, stress survey, fatigue testing, and full complement of NC equipment and a computerized production control system.

EXPERIENCE: Menasco Ltd has produced equipment for the following manufacturers and aircraft - Boeing (727, 737, 757, CH-47); Bell (YAH-63, V-15); Canadair (CL-41, CL-84); DeHavilland (DHC-5, DHC-7); Fairchild Republic (A-10); Fokker VRW (F-28); General Dynamics (F-111); Lockheed (C-141, C-5A); McDonnell Douglas (DC-10); Short Bros (SD3-30); and LTV. Program and facilities have been approved by major military prime contractors and government agencies in the US and Canada.

KEYWORDS: 1=Aircraft; 12=Machining; Landing Gear Components=1, 12; Landing Gears=1; Helicopter Systems=1; Flight Control Systems=1; Control Systems=1; Hydraulics=1; Ground Steering Systems=1; Wing Actuation Systems=1; Components=1, 12.

REVISED: Nov 82.

COMPANY: MICROTEL PACIFIC RESEARCH Ltd

CODE: MPR

ADDRESS: 8999 Nelson Way
Burnaby, British Columbia, Canada V5A 4B5

CONTACT: Mr. Mal Phillips, Custom IC Manager - (604) 294-1471

HISTORY: Microtel Pacific Research Ltd is the wholly owned research and development subsidiary of AEL Microtel Ltd. The headquarters building of MPR is located in the Discovery Park Complex at Simon Fraser University on Burnaby Mountain near Vancouver, BC. In addition to the modern facilities available within the headquarters building, employees have open access to many of the services provided by Simon Fraser University. A branch office, whose staff are engaged primarily in telecommunications related planning studies and standards activities, is also maintained in Ottawa.

CAPABILITY: MPR's primary role as an R&D facility is to develop telecommunications, switching, transmission, and terminal equipment products for manufacture and marketing by its parent. However, the company also performs advanced systems studies in the areas of network planning, new services development and product planning for its parent and under contract to BC Tel, the Trans Canada Telephone System and other organizations. An important aspect of the development activities is the design and development of custom large scale integrated circuits, thick and thin film hybrids, polylithic crystal filters and other critical components. The Pacific Microelectronics Center, a division of MPR, offers component design and development services to outside manufacturers. The principal areas of research and development are summarized below:

- . Digital Switching Systems
- . Subscriber Terminal Equipment including apartment entry systems (Enterphone), modems, and telephone sets
- . Satellite Communication Systems
- . Microwave Radios
- . Frequency Division Multiplex Modulation Equipment
- . Pulse Code Modulation Systems
- . Power Supplies
- . Business Information Systems including a variety of Telidon videotex terminals and converters
- . Supervisory and Control Systems
- . Systems Studies including network, services and product planning and human factors research
- . Microelectronics and Component Design and Development

. Support Activities, such as computer services, model shop, library services, component evaluation and test

AVERAGE WORK FORCE: Professionals - 272

GROSS SALES: No Data

PLANT SIZE: 95,000 sq ft (Systems Design Area)
5,000 sq ft (Clean Room Area)

EXPERIENCE: Experience has been primarily with its parent company, AEL Microtel Ltd.

KEYWORDS: 5=Communications; 7=Electronics; 18=Space Systems;
Systems Studies=5; Large Scale Integrated Circuits=7; Solid State Devices=7;
Thin Film Hybrid=7; Thick Film Hybrid=7; Polyolithic Crystal Filters=7;
Component Development=5, 7; Component Design=5, 7;
Digital Switching Systems=5; Switching=5; Satellite Communications Systems=5,
18; Radio=5; Microwave Systems=5; Multiplexers=5; Modulation Systems=5;
Power Supplies=5, 7; Supervisory Control=7; Microelectronics=7; Digital=5.

REVISED: Nov 82.

COMPANY: MILLER COMMUNICATIONS SYSTEMS Ltd

CODE: MCS

ADDRESS: 300 Legget Drive
Kanata, Ontario, Canada K2K 1Y5

CONTACT: Mr. Allan Miller, President - (613) 592-3020

HISTORY: Miller is a high technology company founded in 1974 with no US subsidiaries. It was originally formed as a systems engineering company specializing in the planning, design, and implementation of a wide range of communication systems.

CAPABILITY: Miller's current research efforts are directed towards military systems, automatic test & monitoring systems, digital communication terminals, and systems upgrading & life extension. Their expertise and areas of interest are outlined as follows:

Communications: Satellite - SCPC & DAMA, TDMA, & SSMA; and HF - Syncomplex, Spread Spectrum, Maximum Likelihood Receiver, and Voice Privacy.

Electronic Warfare: ESM - ESM Receiver, Noise Monitoring, and Spectrum Monitoring; ECM - Jamming; and ECCM - Spread Spectrum, Interference Cancellation, and Null Steering Antenna.

Navigation and DF: Navigation - GPS Navstar & Sarsat; DF - VHF DF, HF DF, and Null Steering.

Radar: Studies and High Speed Digital Processing.

Miller's company objectives are to; (1) substantially increase non-government sales, (2) increase sales in the US (to 20% level), (3) shift technology base to defense systems, (4) develop TDMA and SCPC as a product line, (5) develop related products (primary devices, syncomplex, monitoring equipment), and (6) develop a qualified, cost effective manufacturing capability (design and build, and build to print).

Miller's Manufacturing Division is equipped with tooling and staff to permit competitive execution and quick turnaround of complex, moderate quantity jobs. It is primarily responsible for building Miller systems and products. Upgrading and overhaul & repair is also undertaken.

AVERAGE WORK FORCE: Engineers - 40
Others - 25 (200 employees projected by 1985)

GROSS SALES: 1979 - \$1.0M
1980 - \$1.3M
1981 - \$2.0M
1982 - \$3.0M
1985 - \$10.0M (projected)

PLANT SIZE: 15,000 sq ft (expansion possibility to 40,000 sq ft on present site)

EXPERIENCE: Present customers include various departments of the Canadian Government, various industries in the private sector of Canada, the US, and Europe. They are interested in doing business with the DOD in general and with the USAF in particular.

KEYWORDS: 5=Communications; 7=Electronics; 15=Radars; 17=Software Services; 18=Space Systems; 19=Testing/Test Equipment; Ground Stations=7, 18; Navigation=7, 18; Radio Communications=5, 18; HF Communications=5; Data Acquisition=18; Data Processing=18; Communications=18; Test Equipment=19; Test Instrumentation=19; Signal Processing=15; Satellite Communications=5, 18; Adaptive Receivers=5; Modems=5, 7, 17, 18; Digital Modems=5; Signal Identification Systems=5; Electronic Warfare=5, 7; Telecommunications=5; Terminals=5, 7, 18; Synthesizers=5; HF Modems=5, 7, 17, 18; HF Adaptive Antenna Arrays=5, 7; Spread Spectrum Modems=5, 7; Automated Monitoring & Control Systems=5, 18; Digital Communications=18; SCPC=5, 18; DAMA=5, 18; TDMA=5, 18; SSMA=5, 18; Voice Privacy Communications=5; Jamming=5; Repair & Overhaul=7; Build To Print=7; System Design=5, 18; Spectrum Analysis=18; UHF Telemetry Transmitters=5.

REVISED: Oct 82.

COMPANY: MPB TECHNOLOGIES Inc

CODE: MPB

ADDRESS: P. O. Box 160
21051 N Service Road
Ste Anne de Bellevue, Quebec, Canada H9X 3L5

CONTACT: Dr M P Bachynski, President - (514) 457-2035

HISTORY: MPB is a Canadian owned high technology company that was incorporated in 1976. It is a spin-off from RCA Ltd. There are no other locations in Canada and no US subsidiaries.

CAPABILITY: MPB is located in space previously occupied by the R&D laboratories of RCA Ltd. They acquired many of the assets of the former laboratories and are fully facilitated to conduct experimental, theoretical, and developmental work in a variety of fields. These include lasers, electromagnetics and radars, digital electronics, and instrumentation.

Laser work includes the design and development of CO₂ continuous wave lasers (1-20 watt range, >10,000 hours lifetime, sealed off) and CO₂ waveguide lasers with wide band width and good tunability (sealed off, 10,000 hours lifetime). They have a capability with iodine lasers in conjunction with mode locking experiments, and have conducted laser spectroscopic studies. They have also been involved with heterodyne detection techniques in conjunction with optical fiber hydrophones that can measure 1/500 of a fringe (phase shift: 360/500°). A program is in place for the development for far infrared lasers, a FIR heterodyne receiver breadboard, and the construction of advanced FIR detector packages including reflector mounts. They are involved in a program on the application of lasers to satellite communications (MILSATCOM) and are developing a laser communications test bed and propagation measurement facility for a Canadian Government laboratory.

In the area of electromagnetics and radar technology, MPB has carried out research with synthetic pulse radar for airborne measurement of sea-ice thickness, and in the area of radar/chaff interaction and target enhancement. They have been involved with communications analysis (cross polarization effects, earth and satellite communications), and oil spill detection using electromagnetic techniques and antenna research (wide-band VLF antennas). The company is developing a C-band scatterometer for measurements of ice surface roughness.

In the digital electronics area, MPB has gained expertise in electronic graphics, displays, training systems, and graphic composition. They have also been involved with special purpose communication terminals (transcontinental telephones) and special purpose recorders (based on microprocessor technology).

In the area of instrumentation, MPB is involved with a Space Shuttle experiment (wave injection facility), hazardous gas detection, the Canadian Varennes Tokamak (data acquisition, preionization, diagnostic instrumentation - probes, lasers, microwave interferometry), and software development (controls and on-line data analysis).

MPB products include the VISTA 80 Graphics System, a versatile character generating system which utilizes a standard keyboard for message composition, and a magnetic diskette system for bulk storage of messages. The system is based on microprocessor technology. Primary use is for presenting alphanumeric information in news, weather, sports & election programs, and for titling & credits. The company recently introduced their VISTA 90 electronic graphics and composition system for applications to business and science. The system permits the composition of picture quality graphics by various input devices and hard copy through a choice of 35mm slides, printer, or video tape. Their laser communications system is capable of video, multiple voice channel, or high bit rate digital transmission. The system has a video signal to voice ratio greater than 60 dB and is immune to RF interference. They have made major sales to the US of their sealed-off CO₂ lasers that are long lived (greater than 38,000 hours) and have power ranges from 3 to 12 watts TEM⁰⁰ and 1 to 18 watts multimode. Suggested uses are optical communications, atmospheric research, spectroscopy, far infrared laser excitation, materials processing, surgery, etc. Their final product is a High Intensity Light Source. It is a long (450mm) self-starting vortex stabilized arc discharge. It has a continuous radiation spectrum, can be started instantaneously and can deliver a hundred times more light output than a high power mercury arc lamp light-head of comparable dimensions.

AVERAGE WORK FORCE: PhDs - 12
 Engs - 15
 Others - 13

GROSS SALES: 1979 - \$1.3M
 1980 - \$1.5M
 1981 - \$2.0M
 1982 - \$2.5M

PLANT SIZE: 12,000 sq ft

EXPERIENCE: MPB's typical clients include the Canadian Government (Dept of National Defense, Communications Research Center, National Research Council), AFOSR, CBC, SPAR Aerospace Ltd, Telesat Corp, RCA, plus others. Recent US customers have included the Department of Energy (Nevada Div), Hughes Aircraft, and the National Oceans & Atmospheric Administration.

KEYWORDS: 1=Aircraft; 5=Communications; 7=Electronics; 8=Energy; 9=Environment; 11=Lasers; 15=Radar; 18=Space Systems; 20=Miscellaneous; Digital=7; Instrumentation=7, 8, 9; Continuous Wave Lasers=11; Waveguide Lasers=11; Iodine Lasers=11; Far Infrared=11; Synthetic Pulsed Radar=1, 15, 20; Communications Analysis=5, 18; Antennas=7, 15; Pollution Sensing & Analysis=9; Graphics=7; Displays=7; Training Systems=7; Satellite Communications=11, 18; Laser Communications=11, 18; CO₂ Lasers=11; Sealed-Off Lasers=11; High Intensity Light Source=8; Arc Lamps=8; Trace Gas Detection=9; Hazardous Gas Detection=9; Electromagnetics=1, 9, 15, 20; Continuous Wave CO₂=11.

REVISED: Oct 82.

COMPANY: NORPAK Ltd

CODE: NOR

ADDRESS: 10 Hearst Way
Kanata, Ontario, Canada K2L 2P4

CONTACT: Mr. Bill Dawes, Dir, Military, Training & Education Development
(613) 592-4164

HISTORY: Incorporated in 1975, Norpak is a privately owned Canadian company. Canadian locations include a production facility in Pakenham, Ontario, and head office in Kanata. A US branch office is located at 1351 Washington Blvd, Suite #3000, Stamford, Connecticut 06902.

CAPABILITY: Since incorporation, Norpak Ltd has been dedicated to the design, engineering and manufacture of computer-driven display systems. The scope of Norpak's product line ranges from low cost, low resolution raster graphic displays, to sophisticated high resolution image processing systems. The common element in these products has been systems which provide varying degrees of picture presentation and computational capabilities. Whether the application requires simple colored graphs or a complete air traffic controller training system, the goal in Norpak's product development has been to satisfy all user requirements in the most efficient and cost-effective manner.

Products and services available from Norpak include:

Specialized Graphics Display Products - Visual Data Processor, SuperVISION imagery work station.

Color Computer Graphics Systems and Products - Teletext Encoder System, Videotex Information Provider System, GC 1000 Graphics Microcomputer, Integrated Videotex Terminal, MK IV Videotex Decoder, Electronic Projection System.

Custom Products - Norpak develops OEM products for computer graphics, one example being the Apple II Telidon Interface Card.

Services - Norpak's Hemton Group provides expert videotex page designing and creation services, and offers on-site or in-house training programs for videotex systems. The Hemton Group is currently creating an electronic library of graphic images and international symbols to facilitate speed of image preparation. Layout, design, and 35 mm slide presentations are among the creative services available.

AVERAGE WORK FORCE: 225 (includes hardware & software engineers, graphic artists, & R&D management)

GROSS SALES: 1980/1981 - \$7M
1981/1982 - \$10-12M

PLANT SIZE: 40,000 sq ft

EQUIPMENT: Technical facilities at Norpak's two Canadian locations include production equipment and assembly; sophisticated electronic test equipment;

several digital computers; environmental test chamber; and comprehensive in-house stock of electronic components. Other aspects of technical support include draftsmen, electronic technologists, hardware and software engineers, and administrative staff who are available for assisting in the execution of project activities.

EXPERIENCE: Norpak has had experience in applying its computer graphics product line to interactive computer graphic and image processing systems, electronic subsystems, process control and computer-aided design systems for military, commercial and industrial use.

Specific development work undertaken by Norpak includes - an air traffic control simulator system, television captioning system, broadcast videotex system for Time Inc., and a tactical display system for the Canadian military.

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics;
10=Image Processing & Optics; 17=Software Services; 20=Miscellaneous;
Graphics Display=17; Training Simulators=20; Command & Control=17
Satellite Analysis=17; Information Systems=6; 17; Videotex=7; Teletext=5;
Microcomputers=6; Business Terminals=6; Computer Graphics=6, 7, 17;
Graphics=7, 17; Communications Systems=5; Image Processing Systems=10;
Video Display Systems=7; Data Acquisition=17; Data Processing=17.

REVISED: Jul 82.

COMPANY: NORTHERN AIRBORNE TECHNOLOGY Ltd

CODE: NAT

ADDRESS: 1839 1st Ave
Prince George, British Columbia, Canada V2L 2Y8

CONTACT: Mr. W Shawlee, President - (604) 562-2232

CAPABILITY: Northern Airborne Technology Ltd has R&D expertise in avionics, flight recorders, computer systems (airborne), lighted panels (LED/fiber optics), and visual information devices. Their avionics products include external/internal airborne sound systems, communication systems (intercomm, audio cont), and custom avionics control & interface systems.

AVERAGE WORK FORCE:

Management	- 3
Engineering	- 4
Production	- 6
Field Support Staff	- 2

GROSS SALES:

1980	- \$0.12M (6 months)
1981	- \$0.76M
1982/83	- \$0.85M
1983/84	- \$3.20M (forecast)
1984/85	- \$4.30M (forecast)

PLANT SIZE: 6,800 sq ft

EQUIPMENT: Northern Airborne Technology Ltd's equipment include machine shop (metal and plastic), engraving shop, artwork studio, photo lab/photo fabrication lab, ship/size wiring harness production area (life size jigs for Bell 206, Aerospatiale, Astar, Twinstar), and assembly & testing equipment for avionics products for in-house or vendor produced equipment.

EXPERIENCE: Listed below are clients of Northern Airborne Technology Ltd and status of their projects:

Client: Wulfsberg Electronics, Quebec Provincial Police, Ontario Provincial Police, Department of National Defense. Target: Design a portable clandestine wideband VHF FM communications system based on the RT7200/RT900 transceiver core. Completion: Complete system designed and built incorporating a unique planar radiator antenna and all voltage switching power supply. The unit was indistinguishable from an ordinary briefcase in all aspects excluding weight, and was tremendously successful in extensive security agency field trials. On proof of concept, wulfsberg has now offered the TC1 transit case as a standard product.

Client: Department of National Defense. Target: Redesign internal illumination of the C722/C962 FM control head to insure consistent performance with other cockpit lighting. Completion: Two step LED dimming circuit was modified to provide linear dimming while retaining correct daylight operation. Circuit redesign was simple and easily carried out by Department of National Defense as a field modification without major expense or rework. Adopted into all units in service.

Client: Canadian Coast Guard. Target: Provide a high capability audio inter-communication system for the SRN6/Search & Rescue Hovercraft that would interface fundamentally incompatible radios to standard headsets. Reliable multiple station intercom operation was required under extreme noise conditions. Completion: A modular, ultra-flexible audio system and interface were designed and installed in the SRN6. The resulting new performance levels and concepts now form the basic craft standards.

Client: National Research Council. Target: First hardware phase of the HSA70 Helicopter stress analyzer. The HSA70 is a self-adaptive micro-processor system that provides spoken advisory to helicopter pilots for accident avoidance. Flight data recorder capability via non-volatile storage is also scheduled. Progress: Initial hardware/software interaction underway, airframe interface circuitry designed.

Client: R&D. Target: Develop an all-attitude crashworthy ELT antenna system for helicopters. Progress: Planar antenna feasibility demonstrated, production techniques under consideration.

Client: Hughes Helicopters. Target: Design a technically improved, but harness compatible, audio controller to replace the C6533 Military Controller. Progress: Working prototypes of all functional blocks produced. Mechanical model demonstrated. Preproduction status at this time. Further research underway to demonstrate feasibility of all solid state 560 nm panel illumination to reduce interference with night vision systems.

Northern Airborne Technology Ltd has also acted as technical advisor in the following projects and assignments:

- . Feasibility of low cost computer interface for photogrammetric digitizer.
- . Design of solid state control system for Vinten airborne camera.
- . Theory proposal for remote real estate monitoring system.
- . Theory proposal for computer monitored home and business security system.
- . Design of new electrical system for the Canadian Coast Guard SAR Hovercraft.

KEYWORDS: 1=Aircraft; 3=Avionics; 5=Communications; 6=Computers; 10=Image Processing & Optics; 12=Machining; 14=Protective Equipment; 20=Miscellaneous; Analyzer=1, 14; Audio=3, 5; Cables=1; Clandestine=5; Communications Systems=5; Computer Systems=1, 6; Controls=1, 3, 5; Fiber Optic Illumination=1; Intercommunication Systems=5; Lighted Panels=1, 10; LEDs=10; Noise=5; Night Vision=1; Panels=1, 10; Photo-Fabrication=20; Speech=3; Stress Analyzer=1, 14; Voice=3; Wiring=1; Helicopters=1; Instruments=1; Flight Recorder=1; Visual Information Devices=1; Interface=3; Electrical Systems=1, 20; Antennas=3; Plastic Fabrication=12; Engraving=12; Harnesses=1; Repair & Overhaul=3.

REVISED: Aug 82.

COMPANY: NORTHWEST INDUSTRIES Ltd

CODE: NWI

ADDRESS: Hangar #14, Municipal Airport
Edmonton, Alberta, Canada T5J 2K5

CONTACT: Mr. F A (Floyd) Maybee, Operations VP - (403) 455-3161

HISTORY: Northwest Industries Ltd, incorporated in 1943, is a subsidiary of CAE Industries Ltd, Toronto, Ontario, Canada.

CAPABILITY: Northwest Industries Ltd has the experienced personnel and facilities at the Edmonton International and Municipal Airports, to accommodate complete overhaul, repair and modification of military and civil operators's aircraft. Extensive ground handling and testing equipment supported by an up-to-date technical publications library insures a turn-around with minimum of ground time. NWI's Mobile Repair Parties are equipped to service operator's fleets of aircraft off-site at any location with full technical support. The company is equipped to service the latest in Radar, avionics and aircraft electronic equipment.

The manufacturing facility is capable of manufacturing aircraft components ranging from the floor assemblies and bulkheads of the wide body Lockheed L-1011 Tristar, the complete empennage of the Scottish Aviation Jetstream, and the center wings and aft fuselage of the Boeing 707 to composite fiberglass epoxy conditioned air ducts for the Lockheed L-1011, electronic component racks and miniaturized circuitry for Hughes Aircraft company and sophisticated mechanical cable assemblies incorporated in the Spar Aerospace remote manipulator arm of the Columbia Space Shuttle.

<u>AVERAGE WORK FORCE:</u>	Engineering	- 15
	P Eng (2)	
	Quality Control	- 25
	Production	- 250
	Admin & Other	- 210

GROSS SALES: \$18M

<u>PLANT SIZE:</u>	Edmonton Municipal Airport	- 250,000 sq ft
	Edmonton International Airport	- 50,000 sq ft

EQUIPMENT: Test and Inspection Equipment - avionics electronics; electrical hydraulics and mechanical test equipment; NDT radiographic; and ultrasonic and X-ray equipment.

Production Equipment - three axis, three spindle NC milling machines (25ft x 8ft); autoclave (6ft dia x 18ft); precision jig boring machine (98 in x 48 in table); drop hammer table (63' x 36"); rubber pad hydraulic forming press table (76 in x 76 in); hydraulic stretch wrap forming machine (20 tons); precision tube bender up to 3 1/2" OD capacity; cable swaging, splicing and proof loading; and heat treatment, cadmium plating, and anodizing.

A complete 60 page listing of equipment is available from Northwest Industries Ltd on request.

EXPERIENCE: Northwest Industries Ltd customers include, Government of Canada Department of National Defense, United States Air Force, Spar Aerospace, Lockheed California Co, Hughes Aircraft Co and other major aircraft manufacturers and operators. The company holds Canadian Department of National Defense Approval No. 686-1/44, Canadian Ministry of Transport Approval No. 3/57 and US Federal Manufacturers Code No. 35598.

KEYWORDS: 1=Aircraft; 3=Avionics; 7=Electronics; 12=Machining; 19=Testing/Test Equipment; 20=Miscellaneous; Structural Modification=1; Repair & Overhaul=1, 3, 7; Non Destructive Testing=19; X-Ray=19; Installations & Servicing=3, 7; Instrument Repair=1; Instrument Servicing=1; Structural Components Manufacture=1; Flight Surface Manufacture=1; Tooling=12; Die Fabrication=12; Sheet Metal Fabrication=12; Fiberglass Composite Component Manufacture=1; Wiring Harness Fabrication=1; Control Cables Fabrication=1; Component Fabrication=1, 7; Tubing Assembly Fabrication=1; Technical Publications Production=1, 3, 7; Technical Writing=20; Hydraulics=19; Technical Illustration=20.

REVISED: Jun 82.

COMPANY: ONTARIO RESEARCH FOUNDATION

CODE: ORF

ADDRESS: Sheridan Park
Mississauga, Ontario, Canada L5K 1B3

CONTACT: Iain Murray, Project Officer - (416) 822-4111, X348

HISTORY: Ontario Research was founded in 1928 by equal financial contributions of Canadian industry through the Canadian Manufacturers' Association and the Ontario Government.

As a contract research organization, Ontario Research provides comprehensive technological capabilities to small and medium companies that are not large enough to have their own research and development facilities, and technological specialization to larger companies to complement their own in-house resources. It also offers a variety of testing and analytical services to assist in problem-solving. All Ontario Research services are conducted on a confidential basis. Patents resulting are assigned to the client.

Ontario Research has its laboratories, shops and offices divided between a main building and two pilot plants in Sheridan Park Research Community near Toronto, Ontario.

CAPABILITY: Ontario Research's professional and technical support staff form project oriented teams on the basis of related scientific disciplines. Areas of major emphasis include energy, environment, materials, products and processes, and resources.

Ontario Research is active in the management of energy and technological development of new sources. It helps clients minimize energy wastes, and examines energy sources like coal, wind, sun, oil and waste recovery. Also in place is an alternate fuel utilization program.

An independent authority on the assessment and correction of pollution problems, Ontario Research is involved in the examination and evaluation of water, air, noise and waste. Over many years it has developed a host of environmental services such as instrument design, odor and emission analyses, waste treatment, analysis of trace metals and organics along with sewage systems development and evaluation.

Durability, resilience, corrosion resistance, and properties control are but a few areas in which Ontario Research scientists and engineers have conducted materials research and development. They have tested and evaluated materials which range from high strength steels to plastics, ceramics, textiles and asbestos.

New or modified products and processes form a significant portion of the technological output at Ontario Research. Scientists and engineers combine skills in the development of industrial processes or the design and manufacture of a product. They can update, refine or modify to widen the scope of application, cut costs and create new markets.

Optimum use of natural resources is a goal continually pursued by the Ontario Research team. In the technological development of minerals, Ontario

Research is a partner from exploration to final product markets. Included in this development are such non-metallic minerals as asbestos, clay and gypsum. It is also a leader in wood science.

<u>AVERAGE WORK FORCE:</u>	PhDs	- 35
	BSs	- 55
	Engs	- 35
	Others	- 310

<u>GROSS SALES:</u>	1979 - \$11.8M
	1980 - \$14.4M
	1981 - \$16.7M

PLANT SIZE: 275,000 sq ft

EQUIPMENT: Ontario Research Foundation has an investment in equipment of over \$11.5M, ranging from scanning/transmission electron microscopes, to tensile test equipment capable of exerting a force of 400,000 lbs; and fire and flammability facilities which can accommodate assemblies as large as 15 x 20 sq ft in area.

The National Solar Test Facility is also located at the Foundation, and is the only one of its kind.

The facilities at ORF allow R&D effort to be directed to the following areas:

Alternate Fuel Technology	Photovoltaics
Waste Heat Recovery	Textiles Technology
Solar Systems Monitoring	Pulp and Paper Products
National Solar Test Facility	Product Equip & Mach Design & Develop
Ambient Air Quality Assessment	Modal Analysis
Source Sampling	Tech & Economic Evaluations
Asbestos Measurement & Control	Asbestos Processing
Mutagenic Testing	Uranium Processing
Wet Oxidation	Forest Utilization
Solid Waste Treatment & Recovery	Energy from Biomass
Radiation Measurements	Mineral & Non-metallic Min Processing
Metals, Glass & Ceramics	Water Treatment & Water Pollution
Wood & Wood Composites	Trace Analysis of Organics & Metals
Biomaterials & Bioengineering	Microbiological/Biochemical Processes
Leather	Fire & Flammability Measurements

EXPERIENCE: Recent government and industrial clients include the Environmental Protection Agency, the Food & Drug Administration, Canada Center for Mineral and Energy Technology, the National Research Council of Canada, London Nuclear Decontamination Ltd, Defense Research Establishment, and Spar Aerospace Ltd.

KEYWORDS: 4=Chemistry; 8=Energy; 9=Environment; 12=Machining;
14=Protective Equipment; 16=Security & Safety; 19=Testing/Test Equipment;
20=Miscellaneous; Photovoltaics=8;
Product Equipment & Machinery Design & Development=12; Asbestos Processing=4;
Uranium Processing=4; Energy from Biomass=8;
Water Treatment & Water Pollution=9; Trace Analysis of Organics & Metals=9,

19; Microbiological & Biochemical Processes=9; Alternate Fuel Technology=8;
Waste Heat Recovery=8; Solar Systems Monitoring=8;
National Solar Test Facility=8; Ambient Air Quality Assessment=9;
Asbestos Measurement & Control=9, 16, 19; Mutagenic Testing=19;
Solid Waste Treatment & Recovery=9; Radiation Measurements=14, 19;
Metals, Glass & Ceramics=19; Wood & Wood Composites=8, 20;
Biomaterials & Bioengineering=8; Fire & Flammability Measurements=16, 19.

REVISED: May 82.

COMPANY: OPTECH Inc

CODE: OPI

ADDRESS: 701 Petrolia Road
Downsview, Ontario, Canada M3J 2N6

CONTACT: Mr. S Sizgoric, General Mgr - (416) 661-5904

HISTORY: Incorporated in 1974, Optech Inc is Canadian owned. There is only one location at the above address.

CAPABILITY: Optech Inc has a broad capability in electro-optical systems with specialization in laser ranging systems. They have designed, developed and manufactured laser systems for atmospheric diagnostics (i.e., atmospheric lidars), water depth measurement, wave height analysis, terrain profiling and high resolution (0.1m) distance measurements. Custom fabrication and R&D capabilities. Primary capabilities are in research, development and systems engineering. Production to date has been limited to custom systems and small volume runs.

<u>AVERAGE WORK FORCE:</u>	PhDs	- 4
	Engs & Scs	- 5
	Techs	- 3
	Others	- 2

GROSS SALES: 1981 - \$0.75M
1982 - \$1.00M (forecast)

PLANT SIZE: 5,500 sq ft

EQUIPMENT: Laser fabrication, and test facilities; optical, electronic, and mechanical assembly areas. Laser propagation laboratories. PDP computer systems for data acquisition and analysis.

EXPERIENCE: - Mobile atmospheric lidars for Ontario Hydro and the Canadian Atmospheric Environment Service.

- . Development and operation of Airborne Laser Bathymeter for Canada Center for Remote Sensing.
- . Precision airborne Laser Surface Profilometer for the Canadian Department of the Environment, Ice Reconnaissance Branch.
- . Laser Smoke Cloud Mapper for the Canadian Department of National Defense.
- . Two channel Raman lidar for water content measurements in a maritime atmosphere developed for Memorial University, St John's, Newfoundland.
- . Airborne laser wave height analysis system for the Defense Research Establishment Pacific.
- . Raman lidar for hydrocarbon gas detection for British Gas Corporation.
- . Gallium arsenide range finders for high resolution distance measurements delivered to a number of commercial customers.

- . Precision laser altimeter/profilometer for airborne surveys, developed for customers in Canada and the US.
- . Military electro-optic studies and laboratory measurement programs for Defense Research Establishment Valcartier.
- . Water depth studies using Airborne Laser Bathymeter for Swedish Department of Defense.

KEYWORDS: 1=Aircraft; 8=Energy; 9=Environment; 10=Image Processing & Optics; 11=Lasers; 20=Miscellaneous; Lidar=8, 9, 11; Bathymeter=1, 9, 11; Terrain Profiler=1, 9, 11; Range Finder=8, 9, 20; Electro-Optics=10; Atmospheric Optics=9, 10, 11.

REVISED: Jun 82.

COMPANY: OPTO-ELECTRONICS Ltd

CODE: OEL

ADDRESS: 2538 Speers Road, Units 9 & 10
Oakville, Ontario, Canada L6L 5K9

CONTACT: Dr B K Garside, President - (416) 827-6214

HISTORY: Opto-Electronics is a high technology company incorporated in late 1976 with no subsidiaries in the US. The company was formed with the primary goal of carrying out research, development, manufacturing, and marketing of high technology electronic components, devices, and instruments.

CAPABILITY: Opto-Electronics fields of expertise lie in the areas of industrial control instrumentation, fiber optic systems, optical communications, electro-optics & instrumentation, fast optical sources & detectors, high voltage pulse techniques, solid state electronics, laser devices, and sensors & transducers. Past year activities include new product development and manufacturing as well as contract research of special ultra-high speed photodetectors, ultra-high speed diode laser light sources, and a line of industrial electro-optical process monitors & controllers. The company introduces an average of four products per year. Current research projects include ultra-fast photodetectors, ultra-fast laser diode sources, industrial monitors & controllers, a fiber optic data link, high voltage pulse measurements, a surface spark gap laser switch, and an electronic streak camera.

<u>AVERAGE WORK FORCE:</u>	Scientists, Engs, & Techs	- 19
	Others	- 2
	Total by end of 1982	- 25 (Projected)

GROSS SALES: 1980 - \$0.5M
1981 - \$0.8M
1982 - \$1.2M (Projected)

PLANT SIZE: 8,000 sq ft

EQUIPMENT: OEL's capability consists of a machine shop, assembly room, dark room, & circuit etching, electronics test & optics test areas, stock room, and shipping & receiving rooms. Five persons are currently assigned to manufacturing. Their R&D facility consists of lasers, optics, electronics & optics design, electronic assembly areas, a chemistry laboratory, materials processing room, areas of microscope & spectral analysis, vacuum work & measurement, and a high voltage shielded room. Also included are special rooms for furnace work, machining and modeling, and a library. The research staff consists of 7 PhDs; 3 Mech Engs; 1 MSc; 2 BSs; and 1 BEng.

Major equipment includes high vacuum evaporator, electron microscope, cryogenic, electrical and optical facilities, spectrophotometer, ellipsometer, diffusion furnace, vacuum furnace, optical microscopes, multiple beam interferometer, electrometers, oscilloscopes, and other associated instruments.

EXPERIENCE: OEL's experience has for the most part been with the Canadian Government. Most products are exported. They have expressed interest in doing business with the USAF.

KEYWORDS: 5=Communications; 7=Electronics; 10=Image Processing & Optics;
11=Lasers; Infrared Instrumentation=7; Industrial Control Instrumentation=7,
10; Fiber Optic Systems=10; Optical Communications=5, 7; Electro-Optics=7, 10;
Instrumentation=7, 10; Fast Optical Sources=7, 10; Fast Optical Detection=7,
10; Detectors=7, 10; High Voltage Pulse Techniques=7; Solid State Systems=7;
Sensors=7, 10; Transducers=7; Photodetectors=10; Laser Light Sources=11;
Laser Diode Sources=11; Measurement Systems=7,10; Data Links=10.

REVISED: Oct 82.

COMPANY: OPTOTEK Ltd

CODE: OPT

ADDRESS: 1283 Algoma Road
Ottawa, Ontario, Canada K1B 3W7

CONTACT: Dr David I Kennedy, President - (613) 746-3100

HISTORY: Optotek Ltd is a high technology company with no other divisions in Canada or the US. Optotek was incorporated in Oct 77 as a spin-off from Bowmar Canada Ltd, a Canadian subsidiary of Bowmar Instrument Corp.

CAPABILITY: Active - (1) Development and manufacture of LED materials and devices based on Group III-V and II-VI compounds, (2) design and manufacture of custom LED arrays for military and industrial applications, and (3) design and manufacture of display-related electronic subsystems and test equipment.

Latent - (1) Alternate (non-LED) applications of III-V compound semiconductors, e.g., FETs, and (2) alternate display technologies, e.g., liquid crystals, electrochromic technology, etc.

Future R&D - Current LED displays, both monochromatic and multicolor, range in resolution from 25 to 1000 lines-per-inch. Future expansion will encompass gallium arsenide field effect transistor and high-speed integrated circuit technology, as well as infrared photodetector technology based on cadmium mercury telluride.

AVERAGE WORK FORCE: PhDs - 2
Engineers - 6
Others - 18

GROSS SALES: Approx \$1.00M (Historical)
Approx \$1.25M (Current)
1983 - \$5.00M (Projected)
15% (to US Military)

PLANT SIZE: 20,000 sq ft (expansion capability to 30,000 sq ft)

EQUIPMENT: Optotek has a full complement of semiconductor processing equipment.

EXPERIENCE: Optotek has experience with the USAF, USN and NASA. They are interested in continuing their business with the DOD and NASA. Past contracts have been in the LED materials, devices, and displays areas. Principal programs with the USAF have been the Multimode Matrix LED Display, the Video Flat-Panel LED Display, and the development of Multicolor LED Displays. The USN programs include manufacturing technology for advanced solid-state data annotation displays and a planned production program involving the RF-4 and P3 reconnaissance systems.

KEYWORDS: 3=Avionics; 7=Electronics; 19=Testing/Test Equipment;
Cockpit Displays=3; Infrared Instrumentation=7;
Integrated High Density LED Displays=3, 7; Solid State Devices=3, 7;
LED Materials=7; LED Arrays=3, 7; Subsystems=7; FETs=7; Semiconductors=7;
Display Technologies=7; Liquid Crystals=7; Electrochromic Technology=7;

Flat Panel Displays=3, 7; Multicolor LED Displays=3, 7;
Data Annotation Displays=3; Electronic Test Equipment=19.

REVISED: Oct 82.

COMPANY: PACIFIC MICROCIRCUITS Ltd

CODE: PML

ADDRESS: 1645-140 St
White Rock, British Columbia, Canada V4A 4H1

CONTACT: Tom Foxall, President - (604) 563-1886

HISTORY: Pacific Microcircuits is a new company incorporated in Apr 1982. It was set up as an affiliate of Mitel Corp for the sole purpose of integrated circuit design.

CAPABILITY: Pacific Microcircuits is a custom integrated circuit design group specializing in the design of CMOS circuitry. The company has the expertise and facilities to design digital and analog CMOS circuits. Typical design activities include the development of integrated circuits from customer schematics or the development of new circuits to meet customer specifications. Pacific Microcircuits has experience in all aspects of design, testing, packaging, and manufacturing to ensure the success of the customer's circuits.

AVERAGE WORK FORCE: Engineers - 4
Layout Designer - 1
Technologist - 1

GROSS SALES: 1982 - \$0.5M (Forecast)

PLANT SIZE: 2,700 sq ft

EQUIPMENT: Pacific Microcircuits employs a VAX 11/780 for circuit simulation, logic simulation, rules checks, schematic verification, and switched capacitor filter design; and a CALMA GSDII Color Graphics System for IC layout, design, digitizing, & editing, plotting, and schematic entry.

EXPERIENCE: Pacific's clients include Mitel Corp and several small companies from British Columbia and California. Specific IC design experience of the company's engineers include memory, telephony components, switched capacitor filters, DTMF receivers, modem design, and CCD devices.

KEYWORDS: 7=Electronics; IC Design=7; Integrated Circuits=7; CMOS=7; Memory=7; ISO-CMOS(tm)=7; Filters=7; Custom=7; Chips=7.

REVISED: Oct 82.

COMPANY: PHALO/OSD

CODE: PHD

ADDRESS: 3530 Pharmacy Ave
Scarborough, Ontario, Canada M1W 2T9

CONTACT: Dr M A Dudley, VP International - (416) 498-9680

HISTORY: Phalo/OSD is a Canadian owned company incorporated in Jan 81. This company is a division of Phalo Electron Inc - a Canadian based corporation, and is a subsidiary of Phalo Corporation of Shrewsbury, Massachusetts.

CAPABILITY: Phalo/OSD is a marketing, manufacturing and systems engineering business, providing fiber optic communication links, products and services for the industrial process control and data processing markets. Their products will consist of fiber optic links and couplers, associated equipment such as fiber splicers and test equipment, fiber optic modems, and services that will include system design, installation, maintenance and test. Anticipated R&D work will consist of the development of data modems which will interface with business computers and peripherals, and of couplers which will interconnect up to 40 fibers.

AVERAGE WORK FORCE: Total - 6

GROSS SALES: No Data

PLANT SIZE: 5,000 sq ft

EXPERIENCE: Although a relatively new company, the personnel on hand are experienced in the fiber optics area through past employment with companies well known for fiber optic expertise. The company is gearing for 50% of their product sales toward the US.

KEYWORDS: 5=Communications; 7=Electronics; 10=Image Processing & Optics; 19=Testing/Test Equipment; Fiber Optics=5, 10, 19; Communication Links=7, 10; Fiber Optic Products=7, 10; Process Control=7, 10; Data Processing=7, 10; Couplers=10; Splicers=10; Modems=7, 10; System Design=10.

REVISED: Jul 82.

COMPANY: PHILIPS ELECTRONICS Ltd

CODE: PEL

ADDRESS: 601 Milner Ave
Scarborough, Ontario, Canada M1B 1M8

CONTACT: Mr. J Y Dror, Dir, Corp Engineering & Development - (416) 292-5161

HISTORY: Philips Electronics Ltd was incorporated in 1941 and is a wholly owned subsidiary of Philips Canada Ltd. The parent company is a wholly owned subsidiary of N V Philips' Gloeilampenfabrieken of The Netherlands. Philips Electronics is organized into three regions with seven branches located across Canada and a Government Liaison Office in Ottawa. The head office is located in Scarborough, Ontario.

CAPABILITY: Philips Electronics Ltd is a diverse organization with activities in almost every aspect of electronics and many electrical products. Their products include advanced electronic equipment for the aeronautical industry, quartz crystals, video display units and ballast transformers for fluorescent and gas discharge lighting. The primary capability of the Navaid Division is design, development, production and testing of ground based aircraft navigation systems. This includes instrument landing systems (ILS), VHF omni-range systems (VOR), and distance measuring equipment (DME). A secondary capability is in air traffic control and related communications equipment. Their system, LORADS, will control air traffic within a radius of 250 nautical miles at altitudes up to 80,000 ft.

Other sections with capabilities of possible interest to the USAF are the Video Display Unit and Crystal Divisions. The former designs, develops and produces high resolution color and monochrome monitors. These units are not currently designed to military specifications, but the company is considering incorporating MIL SPEC criteria in the future. The latter division produces piezo-electric quartz crystals for the military and electronics industry. One of their specialties is very high quality glass-encapsulated crystals of the type used in satellites. These crystals are produced to military specifications.

The Philips Department for Standards and Tests is a Canadian Government certified test laboratory. This department not only tests Philips' manufactured items, but also equipment from outside sources such as the Canadian Forces and the US military. Philips Electronics is also carrying out research in fiber optics technology. Their current efforts are in conjunction with their parent organization in The Netherlands and is not product oriented.

AVERAGE WORK FORCE: Navaid Division:
Engineers - 2
Production/Management - 42
Others - 16

Video Display Unit Div:
Engineering Dept - 45

GROSS SALES: Navaid Division - \$4/\$8M (Year)
Video Display Unit Div - \$16.0M (Year)

PLANT SIZE: 432,000 sq ft (Total)

AD-A126 540

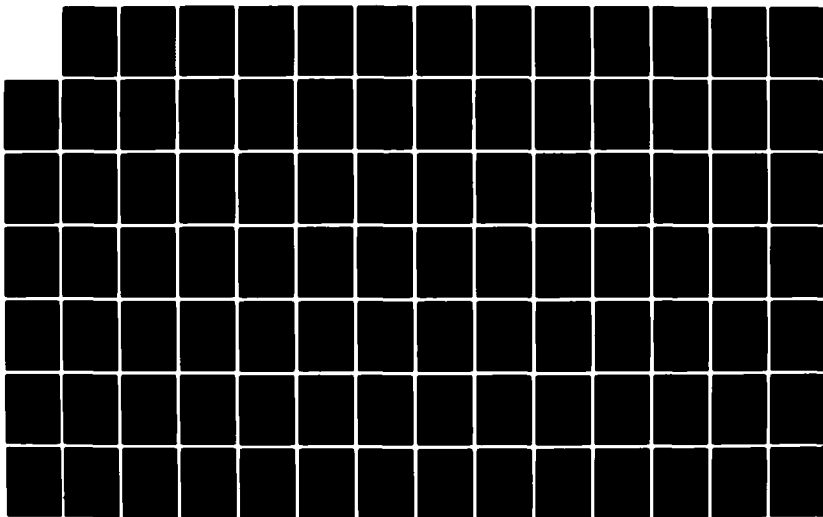
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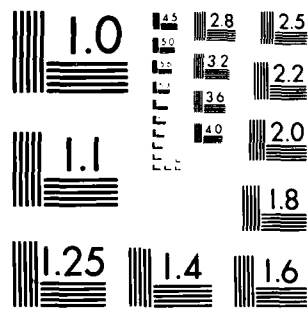
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

EXPERIENCE: Philips Electronics customers include the Canadian Government, the US military, Hughes Aircraft Co, GE, Xerox Corp, IBM Corp, DEC and many more throughout the US, Canada, and the world.

KEYWORDS: 3=Avionics; 5=Communications; 6=Computers; 7=Electronics; 19=Testing/Test Equipment; 20=Miscellaneous; Crystals=7; Piezo-Electric Crystals=7; Quartz Crystals=7; Video Display Units=6, 7; Monitors (VDUs)=6; Ballast Transformers=20; Navigation (Ground Based)=3, 20; ILS (Ground Based)=3, 20; VOR (Ground Based)=3, 20; DME (Ground Based)=3, 20; Air Traffic Control Systems=5, 20; Testing=7, 19; Fiber Optics=7.

REVISED: Nov 82.

COMPANY: PHOTOCHEMICAL RESEARCH ASSOCIATES Inc

CODE: PRA

ADDRESS: 45 Meg Drive
London, Ontario, Canada N6E 2V2

CONTACT: Dr R C Miller, Director of Marketing - (519) 686-2950

HISTORY: Photochemical Research was incorporated in mid-1976. It is a Canadian owned high technology company with a US sales office located in Oak Ridge, Tennessee.

CAPABILITY: PRA is involved in the design, development and manufacture of electro-optical instrumentation systems; specifically in light generation, detection and analysis. Their present product lines consist of luminescence decay systems for the reliable measurement of short lived fluorescence life times; pulsed light sources with pulse widths from picoseconds to seconds and spectral ranges from the VUV to the IR; CW light sources and a line of optical building blocks; Photon Counting Systems for low light level detection; and a line of long-life Helium/Neon lasers.

In addition to manufacturing standard products, they operate research and laboratory facilities for custom manufacturing, contract research, and consulting. PRA operates on an international basis through offices in Canada and the US, as well as through distributor networks in Europe and the Far East.

AVERAGE WORK FORCE: Scientists/Engineers - 25
Others 55

GROSS SALES: No Data

PLANT SIZE: 22,500 sq ft

EXPERIENCE: PRA has sold their off-the-shelf products to a variety of academic, industrial, and government research facilities including - Lawrence Livermore Laboratories, Oak Ridge National Laboratories, Los Alamos Scientific Laboratories, Solar Energy Research Institute, Exxon Research, Bell laboratories, Western Electric, and Eastman Kodak.

KEYWORDS: 7=Electronics; 10=Image Processing & Optics; 11=Lasers;
19=Testing/Test Equipment; Electro-Optical Instrumentation=7, 10, 19;
Light Generation=7; Light Detection=7; Light Analysis=7;
Luminescence Decay Systems=7; Pulsed Light Sources=7;
Continuous Wave Light Sources=7; Optical Building Blocks=7, 10;
Photon Counting Systems=7; Helium Neon Lasers=11; Contract Research=7, 10, 11.

REVISED: Jul 82.

COMPANY: PHOTOVAC Inc

CODE: PHV

ADDRESS: 134 Doncaster Ave
Unit 2
Thornhill, Ontario, Canada L3T 1L3

CONTACT: Dr Richard C Leveson, President - (416) 881-8225

HISTORY: Incorporated in 1975; Canadian owned.

CAPABILITY: Photovac's distinctive competence is in the ability to, (a) design and manufacture instrumentation for the detection and analysis of gaseous and vaporous contaminants in air, and in other gases, at extremely low concentration levels (parts per billion); and (b) to apply this instrumentation, together with technical knowledge, to specific R&D projects. This competence is broadly based in research, product development, systems engineering, and computer design (from scratch); and software development capabilities as these relate separately or in combination to photoionization gas chromatography technology. Photovac's particular technology strength is based on a newly-developed, ultra-sensitive photoionization system which overcomes problems previously experienced with this technique.

AVERAGE WORK FORCE:

Phds	- 2
Engineers	- 3
Research Scientists	- 4
Technicians	- 4

GROSS SALES: 1980 - \$250,000
1981 - \$400,000
1982 - \$800,000 (est)

PLANT SIZE: 2,500 sq ft
7,000 sq ft (planned next 2 years)

EQUIPMENT: Photovac Inc's equipment capability is described below:

- . Instrumentation for air and gas analysis of contaminants with sub part-per-billion detection capability.
- . Available in field portable format including computer interpretation.
- . Available for system installation to carry out multi-point, continuous, high-speed surveillance of air quality.
- . Specialty equipment for investigating short wave-length, ultra-violet phenomena, specially related to gas analysis applications - vacuum UV monochrometer system and mass spectrometer.
- . Modest machine shop capability.

EXPERIENCE: Photovac Inc has had experience with:

- . Development of ultra-sensitive (sub ppb) detector for military applications (AGARD Proceedings #309 "Toxic Hazards in Aviation", B15-1, Sep 80).

- . General Electric - continuous surveillance of arsine and phosphine in new Research Triangle Park facility.
- . Research on preconcentration for ion mobility spectrometer relating to detection of explosive vapors in air at trace levels (Canadian Department of National Defense).
- . Anticipated contract (sole source) from NASA for development of specialized breath analysis system for future Space Shuttle flight.
- . Miscellaneous semi-formal projects and special assignments for EPA (US), Cal OSHA, USDA, US Gas Research Institute.

KEYWORDS: 9=Environment; 19=Testing/Test Equipment; Gas Chromatography=9; Air Analysis=9; Gas Analysis=9; Instrumentation (Air/Gas)=19.

REVISED: Mar 82.

COMPANY: PRATT & WHITNEY AIRCRAFT OF CANADA Ltd

CODE: PWA

ADDRESS: P. O. Box 10
Longueuil, Quebec, Canada J4K 4X9

CONTACT: Mr. S Monaghan, Chief R&D Support - (514) 677-9411

HISTORY: Established in 1928 as a Canadian center for the overhaul of Pratt & Whitney Aircraft radial piston engines. Pratt & Whitney Aircraft of Canada Ltd (P&WC) took over full responsibility for this function prior to moving into small gas turbine development and production. They are a wholly owned subsidiary of the Pratt & Whitney Aircraft Group, a division of United Technologies Corporation.

CAPABILITY: P&WC has the mandate to develop and produce all small gas turbine engines typically for general aviation, commuter and paramilitary use. Their primary business areas are:

- . Small gas turbine engine development
- . Small gas turbine engine production
- . Small gas turbine engine oriented research

The development of gas turbine engines at P&WC started in the late 1950s with the early PT6. This turboprop engine was introduced to the commercial market in 1963. The military designation for this engine is the T74-CP-701. In 1979, the development started on the PW100 turboprop engine. This fuel efficient engine is used primarily in commuter and short-haul aircraft.

The JT15D turbofan engine was introduced in 1967. It is the power plant of the Cessna Citation corporate jet, as well as the Aerospatiale Corvette and the Mitsubishi Diamond 1 aircraft. P&WC has also developed a twin turboshaft engine for helicopter use. These are designated the PT6T-3 and -6 series (military designation is T400-CP-400, -WV-402).

By 1982, the company had delivered 23,000 engines for the world market.

AVERAGE WORK FORCE: Engineers - 612
Others - 991

GROSS SALES: 1979 - \$463M
1980 - \$605M
1981 - \$770M

PLANT SIZE: 1,809,640 sq ft (Total area)

EXPERIENCE: P&WC has had experience with the following organizations:

United States Air Force - (1) Research on High DN Value Roller Bearings - a program to determine the influence of geometric variable etc., on small high speed roller bearings (carried out as a shared development program); and (2) Alternate Fuels Combustion Research - an experimental study of the effects of alternate jet fuels on small gas turbine combustion systems (carried out as a shared development program).

United States Army - (1) Subcontractor in Cooled Radial Turbine Program to Pratt & Whitney Aircraft (P&WA), Government Products Division (GPD) (1969-1971). Pratt & Whitney Aircraft of Canada Ltd was responsible for the Aerodynamic design and participated in the structural analysis and mechanical design of the turbine; (2) Consultant to P&WA, GPD, on ST9 1500 horsepower demonstrator program for new US Army helicopter engine - first stage was scaled P&WC research rotor and second stage was centrifugal compressor (1966-1969); (3) Consultant to P&WA, GPD, for the demonstration of a 10:1 Pressure Ratio single centrifugal compressor - P&WC provided data from previous in-house demonstrations of 10:1 Pressure Ratio Compressors carried in 1967 & 1970 (1970-1972); and (4) P&WC is currently contracted with the US Army at Ft Eustis for a advanced 15:1 Pressure Ratio Single Centrifugal Compressor.

United States Navy - (1) P&WC was a subcontractor to P&WA, Commercial Products Division (CPD), on a demonstration of a regenerative, small turboprop engine based on the PT6 - P&WA designed the regenerator, while P&WC designed the ducting, organized hardware fabrication, and demonstrated the concept (1964-1966); (2) P&WC won a contract to provide a twinned helicopter engine (T400/402 Twin Pac R) to the US Navy for Bell Aerospace helicopters where 1032 units have been supplied - also 2218 units in a civil version (PT6T3/6) have been produced to date - development of the engine is a continuous process and P&WC are performing component improvements through a US Navy contract (1969); and (3) P&WC has also performed as a subcontractor to P&WA, CPD, on a demonstration of single crystal turbine blades for gas turbine operation.

Environmental Protection Agency - (1) P&WC carried out a combustion research program for small, single can, highly loaded combustors for automotive application with good performance and low emissions (1973-1974); (2) P&WC was subcontractor to United Technologies Research Center (UTRC) on a study of the automotive application of gas turbines - carried out a series of cycle studies and supported experimental work on combustion (early 1970s); and (3) P&WC also supported the Environmental Protection Agency (EPA) (Triangle Park) on studies of the carcinogenic effect of small gas turbine emissions (1977-1978).

National Aeronautical Space Administration (NASA) - (1) P&WC was subcontractor to P&WA, CPD, on a turbofan core noise program at Ames carried out on a NASA owned P&WC JT15D engine - P&WC designed and fabricated an alternate fan core stator to increase the axial spacing between rotor and stator, and the number of stator vanes (1977); (2) P&WC was subcontractor to P&WA, CPD, on a program of nose cone telemetry for NASA Lewis Research Center as applied to a NASA JT15D turbofan - P&WC designed a transmitter to operate within the nose of a JT15D to study the difference between ground and flight noise measurements (1978-1980); (3) P&WC was also subcontractor to P&WA, CPD, on a program to supply NASA Langley with copies of the telemetry units from item #2 for flight use with stringent manufacturing requirements (1979-1980); and (4) P&WC was also subcontractor to United Technologies Research Center on a Combustor soot program - all combustor hardware was designed and fabricated by P&WC, while United Technologies Research Center assembled the rig and carried out all testing (1980-1981).

KEYWORDS: 1=Aircraft; 4=Chemistry; 8=Energy; 9=Environment;
19=Testing/Test Equipment; Small Gas Turbine Engines=1; Engines=1;
Turbine Engines=1; Engine Components=1; Engine Systems=1;
Fuel Systems Research=1; Repair & Overhaul=1; Alternate Fuels Research=1, 4;
Roller Bearings=1; Combustion Research=1, 4; Fuels Research=1, 4;
Helicopter Systems=1; Auxiliary Power Units=8; Engine Research=1, 8;
Test Equipment Instrumentation=19; Engine Emission Research=1, 9.

REVISED: Jul 82

COMPANY: PRESENTEY ENGINEERING PRODUCTS Ltd

CODE: PEP

ADDRESS: 2784 Fenton Road
Ottawa, Ontario, Canada K1G 3N3

CONTACT: Mr. S Presentey, President - (613) 822-1251

HISTORY: Presentey is a Canadian company incorporated in 1958 with no other Canadian branches or US subsidiaries.

CAPABILITY: Presentey engages as a prime contractor in a wide variety of activities including research, development, production, and consulting for both the military and private sectors. Over the years, the company has designed and produced an assortment of hardware items that include airborne voice recorders and ground based reproducers for the CF-104 aircraft, transmitter teletypewriter controls for shipboard use, low drift DC amplifiers, multi-channel memory/loop tape recorders for high performance jet aircraft, 14 channel FM/AM data recorder for high altitude research, magnetometers, proton magnetometers, dust monitoring systems, rocket subcommutator, an ASW sonobouy antenna, plus other items. They designed and produced the first Canadian air pollution monitor which is installed at various locations in the Ottawa, Toronto and Montreal areas.

Presentey was awarded all the contracts of a bankrupt electronics firm by the Canadian Government. All those contracts were successfully completed. At least two USAF contracts, transistorized missile check cards and radar target simulators, were part of that deal.

Recent projects include the design and development of the signal patch panel systems for the latest Canadian destroyers and a 64-channel A/D converter/recorder system. They have also been active in the fields of airborne photogrammetry, navigation aids and airborne photography film annotation systems. Another in-house product is a brushless DC motor. It is a low cost, high quality, long life, self-contained compact unit to be used in new equipment designs as well as a replacement for brush type motors in existing equipment. Applications include magnetic tape recorders, reels and capstan drives, film transports in cameras, airborne instruments, chart recorders, printers, blowers and various operations in hostile environments. The company is reasonably self-sufficient. They are equipped to carry out electronics work as well as to design and machine parts, tools, jigs and dies for production of parts, stampings and molds. Production equipment is available for electronics and mechanical operations. They also have the capability to design silicone elastomer molds and have made considerable progress in epoxies processing.

AVERAGE WORK FORCE: Total - 21

GROSS SALES: 1980 - \$1.0M
1981 - \$1.5M

PLANT SIZE: 10,000 sq ft

EQUIPMENT: The company maintains a manufacturing capability in the electronics and mechanical areas. They are equipped with a machine shop for

normal operations. They can carry out heat treating, stamping, tool and die cutting, oxy-acetylene and electrical welding, and sheet metal operations. Limited environmental and vibration testing can be carried out.

EXPERIENCE: Presentey has worked with the Canadian military and has had contracts with the USAF (AFLC). Currently they are under contract with the Canadian Forces to produce their brushless DC motor, and also to develop a brushless blower motor for use in land vehicles and in unattended locations. They have also developed a UHF power amplifier for man-pack radios in vehicle configuration. They are under contract with the Department of Transport to build 40 transmissometers to measure light transmissivity at airports. They are also building simular devices for the Canadian DND.

KEYWORDS: 1=Aircraft; 5=Communications; 7=Electronics; 9=Environment; 15=Radar; 16=Security & Safety; 19=Testing/Test Equipment; 20=Miscellaneous; Voice Recorders=1, 5; Voice Reproducers=5, 20; Ground Based Reproducers=5, 20; Transmitter Teletypewriter Controls=5, 20; Amplifiers=1, 5; Tape Recorders=1, 5; Data Recorder Systems=20; Magnetometers=9; Proton Magnetometers=9; Pollution Sensing=9; Antennas=20; Rocket Subcommutators=20; Converter/Recorders Systems=5, 20; Photogrammetry=1; Film Annotation Systems=1; Motors=20; Brushless DC Motors=20; Simulators=15; Magnetic Anomaly Detection=16; Test Equipment & Instrumentation=19; Environmental Analysis=9; Navigation=1; Target Simulators=15; Power Supplies=7; Flight Data Recorders=1; Instruments=1; Transmissometers=9.

REVISED: Nov 82.

COMPANY: PRIOR DATA SCIENCES Ltd

CODE: PDS

ADDRESS: 16 Credit Union Way, Suite #301
Ottawa, Ontario, Canada K2H 8R6

CONTACT: Larry E Hanlan, Manager, Military Systems - (613) 820-7235

HISTORY: Prior Data Sciences Ltd was founded in early 1977 and has experienced steady growth to its current level of 37 employees (Aug 82). The company is Canadian owned and is located in both Ottawa (Headquarters) and Toronto. There are no US subsidiaries.

CAPABILITY: Prior has capabilities in:

- . "Turnkey" computer systems development
- . All phases of software project development and life cycle support
- . Software engineering consultation and contract support services

Computer systems development may range from microprocessors to mainframes. In the industrial field, Prior has considerable experience with the DEC PDP-11 family of computers, the RSX-11M and RT-11 operating systems, and the Pascal programming language. In the military field, Prior has significant expertise with the UYK-20 and associated computers, and the CMS-2 programming language. They have assumed responsibilities as a software subcontractor, and as a turnkey system developer.

Prior has participated in all phases of software project development. This experience includes:

- . Feasibility studies and requirements analysis
- . Systems analysis, systems specification, and hardware procurement
- . Proposal preparation and evaluation
- . System design and detailed module design
- . Module code and testing
- . System integration
- . Acceptance test plan preparation
- . Software maintenance and enhancements

Software engineering consultation and contract support services can be provided for all of the above phases of software project development, from requirements analysis to software maintenance.

AVERAGE WORK FORCE: Professionals - 32
Others - 5

GROSS SALES: 1979 - \$0.9M
1980 - \$1.4M
1981 - \$2.0M

PLANT SIZE: 2,700 sq ft (Ottawa)
2,000 sq ft (Toronto)

EQUIPMENT: DEC PDP-11/44; Perkin-Elmer 7/32; and ORION VI MDS.

EXPERIENCE: Prior has participated in the following military application areas, Command and Control; Communications; Surveillance; Graphics; and

Simulation.

Prior has worked directly for DND or as a subcontractor on many of DND's recent major projects. These include NFA, CPF, AURORA, ADLIPS, CANEWS and SHINCOM. Prior has successfully teamed with other members of Canadian industry such as Leigh Instruments, Litton Systems Canada Ltd, and Westinghouse.

In the area of military research and development, Prior has had a continuing involvement with projects at the Defense Research Establishment Ottawa and the Communications Research Center. These projects have been concerned with radar, direction finding, electronic warfare, countermeasures, analysis, and simulation.

Sixty percent of the company's work is military-related. There has been no direct contact with the US military. All experience to date has been either with the Canadian Department of National Defense or as a subcontractor on a DND sponsored project.

KEYWORDS: 5=Communications; 6=Computers; 15=Radar; 17= Software Services;
Turnkey Computer Systems Development=6; Project Development=17;
Life Cycle Support=20; Engineering Consultation=6, 17; Feasibility Studies=17;
Requirements Analysis=17; Systems Analysis=17; Systems Integration=17;
Maintenance=17; System Integration=17; System Design=17; Module Design=17;
Hardware Procurement=6, 17; C3 Systems=5, 6, 15, 17; Surveillance=6, 17;
Graphics=6, 17; Simulation=6, 17; Consulting=6, 17; Electronic Warfare=6, 17;
Radar=6, 15, 17; Communications=5, 6, 17; Computer Design=6, 17.

REVISED: Oct 82.

COMPANY: PYLON ELECTRONIC DEVELOPMENT CO Ltd

CODE: PED

ADDRESS: 147 Colonnade Rd
Ottawa, Ontario, Canada K2E 7L9

CONTACT: Mr. Geoff Wheatley, Marketing Mgr - (613) 226-7920

HISTORY: The Pylon organization celebrated its first 25 years of business 21 Mar 80. Within two years of incorporation under Federal Charter in 1955, a development project was begun for the use of transistors in telephone equipment. By the end of 1957, the company was manufacturing solid state 20Hz Ringing Generators. Previously this was done by rotary machinery at high cost and with attending maintenance problems. The concept of a solid state "generator" stuck with the product. By 1959, Pylon was producing both static DC generators and static AC generators. These are frequently called DC-DC Converters or DC-AC Converters. As Pylon were the first to manufacture these devices, the name most commonly used by domestic phone companies was "Pylons", regardless of the type of equipment.

The use of solid state ringing and power conversion in the US came several years later. Telcos were quick to see the advantage of using one central office battery and the conversion method with redundancy for high reliability. In Canada, Pylon is the major supplier of DC-DC Converters and ringing machines.

With the acquisition of Armtrol Ltd in 1970, Pylon entered into the manufacture of solid state switching equipment. A line of trunk concentrators of CAMA application and ROTS apparatus were introduced.

Manufacture of digital equipment began in 1965 with systems involving photoelectric badge readers. The first system formed the basis of data gathering systems for the Post Office. Pylon has supplied a vast range of specialized data equipment to customers in North America and overseas. Pylon offers a complete engineering support team from the system concept through to the end product.

In 1977, the company expanded by opening a division in Ottawa which specialized in the manufacture and development of instrumentation and Geophysical/Nuclear Measurement Systems. The Toronto division was opened in the fall of 1979.

In 1980 due to the growth of the Pylon market, it was decided to build a new development plant in Ottawa and to relocate the Pylon Head Office on completion of this facility. Eighteen months later, this objective was realized.

The company holds 18 Canadian, 12 US, and 3 miscellaneous patents. Approximately 25% of all telecommunication equipment, and over 80% of the geophysical/nuclear equipment is exported.

CAPABILITY: Montreal Branch - Telco Products, Ringing Generators, Ringing Talk Signal Supplies, UPS Systems, CO Power Plants, Custom Transit Cases.

Toronto Branch - Telecommunications Equipment, Custom Instrumentation.

Ottawa Head Office - Manufactures an instrument line of Time Code Generators, Distribution Amplifiers and Large Numerical Displays, the Nuclear Group produces calibrated Radon and Thoron gas generators, Alpha detection and contamination monitoring equipment, an R&D group is currently working on improved beta detection and ionizing radiation.

AVERAGE WORK FORCE: Scientists/Engineers - 30
Others - 100

GROSS SALES: \$4 to \$5M
Projected Sales (2 year period) - \$6 to \$8M

PLANT SIZE: Montreal - 18,000 sq ft
Toronto - 5,000 sq ft
Ottawa - 16,000 sq ft

EXPERIENCE: Canada - Department of National Defense, National Environmental Agencies, National Research Council, Atomic Energy Control Board, Energy Mines & Resources, Bell Canada, Telesat, Trans Canada Tele System, Canadian Broadcasting Corp, and CNCP Telecom; US - Danray Inc, Harris Corp, CBS, NBC, and ABC; and Other Countries - South America, Central America, UK, West Germany, Austria, Italy, Greece, China, Philippines, and Australia.

KEYWORDS: 5=Communications; 7=Electronics; 9=Environment;
19=Testing/Test Equipment; Nuclear Sensors=9, 19; Geophysical Sensors=9, 19;
Nuclear Instrumentation=9, 19; Analysis=9; Simulation=9; Power Supplies=7;
Telephone=5; Voltage Transformers=7; Voltage Regulators=7; PC Board Design=7;
PC Board Fabrication=7.

REVISED: Apr 82.

COMPANY: QUESTOR SURVEYS Ltd

CODE: QSL

ADDRESS: 6380 Viscount Rd
Mississauga, Ontario, Canada L4V 1H3

CONTACT: Mr. P G Lazenby, Chairman - (416) 676-9880

HISTORY: Originally a one aircraft operations section of a mining company, the company split in 1961 and formed a survey services for any mining organization. During this period, the company operated one owned aircraft and three leased aircraft. In 1970, they began expanding operations, and in 1979 acquired the geophysics division of Northway Survey Corporation. During this period, they specialized in the use and development of the Barringer INPUT electromagnetic system. They are Canadian owned and have no subsidiaries.

CAPABILITY: Questor specializes in all state-of-the-art airborne sensing for base metal, uranium and oil. In addition to the Barringer INPUT system (VLF electromagnetics), they also are capable of acquiring and analyzing data from airborne standard & high sensitivity magnetics, and standard & multi-channel spectrometry. They also design and build very high sensitivity magnetometers along with their associated data acquisition systems. Their aircraft fleet includes - two Skyvans, three Trislaners, three DC-3s and an Aero Commander. The INPUT systems generate a pulsed signal from a vertical dipole. Existing conductive ores induce eddy currents in the primary field which form secondary fields. These secondary fields are then sensed. Through analysis of these secondary field anomalies, sulfide and graphite conducting pockets have been identified to a depth of 300 meters. Standard and high-sensitivity magnetometry provide detailed magnetic contour maps. Corrections for aircraft attitudes & maneuvers, and the use of precision clocks, etc., enable Questor to improve the normal high standard government contour maps by a factor of four in geologic resolution.

Gamma ray spectrometers are used to identify potential uranium deposits as well as for geologic mapping and identification of man-made radio-active wastes. Data reduction for all types of sensors/missions is provided by the company's specially developed algorithms and provides a variety of outputs depending on the users' needs.

Questor has recently organized an internal Research Division. They are presently working to improve the various sensors used by Questor to increase penetration, sensitivity and flexibility. Some consideration has been given to becoming involved in remote infrared detection and side looking radar for mapping purposes.

<u>AVERAGE WORK FORCE:</u>	PhD	- 1
	Prof Eng	- 3
	BsE	- 10
	Technicians	- 15
	Others	- 91

GROSS SALES: 1980 - \$6M
1981 - \$8M (Projected)
1982 - No Data

PLANT SIZE: 22,000 sq ft (plus rental hangar space)

EXPERIENCE: Questor's clients include 49 different countries around the world for one or more of their surveys. Their surveys have led to the discovery of fourteen base metals, precious metals, or uranium deposits in a variety of geologic environments. In Canada, customers have included - Noranda Mines, Falconbridge Mines, Inco, Imperial Oil, Shell Oil, and Gulf Oil. They are interested in conducting research for the USAF.

KEYWORDS: 1=Aircraft; 8=Energy; 9=Environment; 17=Software Services; 20=Miscellaneous; Remote Sensing=1, 8, 9, 20; Sensors=8, 9, 20; Pollution=8, 9; Software=17; Mapping=8, 9; Data Acquisition=1, 8, 9, 20; Data Reduction=1, 8, 9, 20; Data Analysis=1, 8, 9, 20; Magnetometers=8, 9.

REVISED: Mar 82.

COMPANY: RAYLO CHEMICALS Ltd

CODE: RAY

ADDRESS: 8045 Argyll Road
Edmonton, Alberta, Canada T6C 4A9

CONTACT: Dr J F Prescott, Technical Manager - (403) 465-7937

HISTORY: Raylo Chemicals is a wholly owned subsidiary of Terochem Laboratories Ltd which is a private Canadian Corp. The company was incorporated in 1963 and purchased by Terochem Laboratories in 1981. Raylo Chemicals has no US subsidiaries.

CAPABILITY: Raylo Chemicals specializes in contract research, custom synthesis, and stock sales of manufactured products. Areas of expertise include bench scale pilot plant design & operation; Synthetic chemistry (natural products, pharmaceuticals & hydrocarbon chemistry); high pressure & temperature reactions; polymer chemistry (synthesis of novel monomers and their polymers, characterization and chemical stability testing); and non-routine analysis. A major contract activity is polymer chemistry applied to elastomers, water soluble polymers, flocculation studies, enhanced oil recovery, and electrolyte cell separators. Other principal projects include pharmaceutical chemistry, supercritical gas technology applied to coal liquefaction & analyses of heavy oil, and development of physical & physicochemical data in support of various commercial industrial processes.

Raylo Chemicals offers custom manufacture of complex chemicals and polymers from a few grams to several thousand kilograms, including process design and development. Raylo routinely handles highly reactive solid, liquid, and gaseous reagents, and can operate under vacuum and inert atmospheres. The following reactions are performed regularly:

- . Acylation
- . Condensation
- . Dissolved Metal Reduction
- . Friedel-Crafts Reactions
- . Grignard
- . Halogenation (substitution and addition)
- . Hydrogenation
- . Hydrolysis
- . Metal Hydride Reduction
- . Optical Resolution
- . Phosgenation
- . Reductions

Raylo Chemicals products include pharmaceutical intermediates, diagnostic chemicals, pheromones, sugars, nucleosides, specialty polymers, and other fine specialty chemicals. Current stock includes over 150 compounds for many of which Raylo is the sole or principal world manufacturer.

AVERAGE WORK FORCE:

PhDs	- 11
Technicians & Operators	- 13
Others	- 5

GROSS SALES: 1980 - \$1.2M
1981 - \$1.4M
1982 - \$2.5M

PLANT SIZE: 10,000 sq ft
6,000 sq ft (Laboratory + Library)

EQUIPMENT: Raylo Chemicals has well equipped laboratories with the following instruments - 60 MHz proton magnetic resonance spectrometer; infrared and ultraviolet spectrophotometers; high performance liquid chromatograph, equipped with a variable wavelength ultraviolet detector with stop-flow capability; gas chromatograph, both packed column and capillary column, with FID and TC detectors; size exclusion chromatography system with differential refractometer; and other up to date chemical, biochemical and physical equipment.

Under an established arrangement with the University of Alberta, high resolution instruments such as Fourier Transform Infrared Spectrometer; Fourier Transform (100, 200 and 400 MHz) and Carbon-13 magnetic resonance spectrometers; and low and high resolution mass spectrometers are available to Raylo's research staff. Raylo also has access to and experience in using a low angle laser scattering photometer (KMX-6), particularly useful for determination of absolute molecular weight and molecular weight distribution polymers.

Raylo's plant equipment includes multi-purpose glass and stainless steel, jacketed, stirred reactors in the 10-600 gallon range and a broad selection of separation equipment.

EXPERIENCE: The company has produced 77 patents and 35 publications. Raylo's clients are government, universities, and industry in the US, Canada, Europe and Japan.

KEYWORDS: 4=Chemistry; Contract Research=4; Custom Synthesis=4;
Petroleum Chemistry=4; Pharmaceutical Chemistry=4; Physical Chemistry=4;
Polymer Chemistry=4; Natural Products=4; Hydrocarbons=4; Monomers=4;
Non-Routine Analysis=4; Elastomers=4; Water Soluble Polymers=4;
Flocculation Studies=4; Electrolyte Cell Separators=4;
Supercritical Gas Technology=4; Acylation=4; Halogenation=4;
Metal Hydride Reduction=4; Phosgenation=4; Diagnostic Chemicals=4;
Pheromones=4; Nucleosides=4.

REVISED: Oct 82.

COMPANY: RAYSHIELD Ltd

CODE: RSL

ADDRESS: 2630 Royal Windsor Dr, Unit #4
Mississauga, Ontario, Canada L5J 1K7

CONTACT: R E Webster, Sales Manager - (416) 822-6100

HISTORY: Rayshield is a wholly owned Canadian company incorporated in 1968 with no US subsidiaries.

CAPABILITY: Rayshield Ltd specializes in the construction of prefabricated RF shielded enclosures, and MIG welded rooms which are completely adaptable to all sizes and shapes of architectural spaces. The system was developed to provide a quality-controlled technique for constructing shielding under adverse field conditions that would ensure a dependable performance. Manually operated doors require a very minimum of effort and are available as single or double units. "Hands-Off" or automatic powered door operators are also available. Performance is tailored to meet requirements. Complete installation and turnkey services including testing and certification are available. A complete line of accessories - vent panels, waveguide penetration, lighting, work benches, and connector panels are available. Power signal and communication line filters are available for all applications including tempest. Rayshield also provides guaranteed performance installations, testing, and servicing.

AVERAGE WORK FORCE:

Engineering	- 4
Manufacturing	- 15
Others	- 5

GROSS SALES: \$1.0 - \$2.0M (Historical)
\$2.0M (Present)
\$2.5M (Forecast)

PLANT SIZE: 10,000 sq ft

EQUIPMENT: Rayshield's Manufacturing Division is equipped with a laminating press to manufacture shielded panels, drill presses, cut-off saws, welders, and other equipment to enable them to manufacture all components of shielded enclosures.

EXPERIENCE: Rayshield has been providing RF & EMP Shielding to major Governments and companies in North America, Europe and the Middle East for over fifteen years.

KEYWORDS: 14=Protective Equipment; 19=Testing/Test Equipment;
RF Shielding=14; EMP Shielding=14; Anechoic Chambers=19;
Shielded Cabinets & Wireways=14; Shielding=14.

REVISED: Oct 82.

COMPANY: RMS INDUSTRIAL CONTROLS Inc

CODE: RMS

ADDRESS: 70 Williams St
Port Moody, British Columbia, Canada V3H 2R5

CONTACT: Harry Dunstan, President - (604) 461-1315

HISTORY: RMS Industrial Controls Inc was incorporated in 1976. The company has displayed steady growth in each succeeding year and has excelled in the field of specialized electronics engineering.

CAPABILITY: RMS particularly excels in the development of telemetry systems, using as transmission mediums both conventional wire and radio. They have developed their own series of unique radio modems to offer the user reliable and secure data radio communications. The company has developed and now manufactures its own unique direct synthesized UHF radio. This radio is rugged and capable of operating in harsh environments. The radio features unusual stability and has been designed to require minimal servicing.

RMS has also developed telemetry and control systems for use in offshore and undersea equipment. As much of this equipment is intended for use in critical conditions, emphasis has been placed on refinement and ruggedness of design. This equipment is used in the control of undersea vehicles and remotely operated manipulators.

Radio remote control of both on-off and analog types is manufactured by RMS for use in the resource, construction, and manufacturing industries. All signalling is digitally encoded and offers excellent security of control.

RMS offers unique capabilities in research and development involving new and unusual applications. The company has demonstrated the ability to solve problems using state-of-the-art techniques. This capability is provided to the user in a coordinated manner, from evaluation to development, and then to production and implementation.

AVERAGE WORK FORCE: Total - 35 (Engineers 35%+)

GROSS SALES: FY 1981/1982 - \$ 1.6M
Next 3 Years - 40 - 60% increase per year (forecast)

PLANT SIZE: 6,000 sq ft
Service Facilities - Houston, TX and Ontario (planned)

EXPERIENCE: RMS has been involved in the continuing development of sophisticated control equipment for unmanned and manned submersible vehicles used in offshore oil industry and by Government Departments. Projects have been completed for the Canadian Defense Research Establishment (Pacific), and for the US Navy. RMS has successfully developed and put into production a sophisticated state-of-the-art synthesized UHF radio transceiver which is used in a wide variety of demanding applications. They company has also developed and put into production radio controls for a variety of applications from simple on-off commands to high resolution analog controls.

KEYWORDS: 5=Communications; 20=Miscellaneous; Telemetry=5;
Data Communications=5 Modems=5; UHF Radios=5; SCADA Equipment=5, 20;
Radio Controls=20; Automatic Vehicles Monitoring (AVM)=5, 20;
Computer Aided Dispatch (CAD)=5; Remote Piloted Vehicles (RPV)=20;
Radio Modems=5, Wire Modems=5; Digital=5, 20; Analog=5, 20.

REVISED: Nov 82.

COMPANY: SCIEX
[Division of MDS Health Group Ltd (MDS)]

CODE: SCI

ADDRESS: 55 Glen Cameron Road, Unit 202
Thornhill, Ontario, Canada L3T 1P2

CONTACT: Dr N M Reid, Marketing VP - (416) 881-4646

HISTORY: Sciex was incorporated in 1970 under provincial charter (Ontario). In late 1981, Sciex amalgamated with MDS Health Group Ltd, a Canadian controlled public corporation. In early 1982, an associate company to MDS Ltd, Sciex, was established in Amherst, New York, and will be conducting marketing operations in the US.

CAPABILITY: Sciex is engaged in the design, R&D, manufacture, servicing, and marketing of trace chemical analysis systems, sample inlet systems, ionization modules, and custom designed application software for the industrial, environmental, health, medical, and military markets. The company currently has the world's leading Atmospheric Pressure Chemical Ionization (APCI) research capability. The Trace Chemical Analysis systems, TAGA® 3000 and TAGA® 6000 MS/MS are the main products of the company. Both systems can be fully mobile and are up to 1000 times more sensitive and 1000 times faster than other available systems. The TAGA® 3000 is primarily used for targeted compound analysis, while the TAGA® 6000 MS/MS is used for rapid mixture analysis and structure elucidation, and in many cases avoiding the preparative steps and time delays of chromatographic separation.

<u>AVERAGE WORK FORCE:</u>	Engineers	-	7
	PhDs	-	12
	Systems Analysts	-	7
	Others	-	54

GROSS SALES: Confidential

PLANT SIZE: 22,000 sq ft

EQUIPMENT: Facilities are geared to specific applications requiring rapid measurement, monitoring or investigation of specific trace components in complex mixtures. Sciex equipment includes:

- Three fully computerized atmospheric pressure ionization mass spectrometers - laboratory based and mobile. The TAGA® 3000 is a single quadrupole MS system. The TAGA® 6000 MS/MS is a triple quadrupole mass spectrometer. Unique features include - detection of compounds at sub-picogram or low parts per trillion level, minimal memory effects which facilitate high sample throughput, high ion transmission, cryogenic pumping, and gas dynamically confined CID target with collision energies to 150 eV. Total system control, data display and manipulation are achieved via the PDP-11/03 or PDP-11/23 DEC computers, with RT-11 (single user) or REX-11M (multi-user) operating systems. The appropriate peripheral terminal, graphic and hardcopy capabilities are integrated with the system.
- With the mobile unit, trace compounds at any accessible site can be detected, identified and their concentrations measured. The extent of

environmental air contamination can be plotted throughout an area rapidly to pinpoint sources of contamination.

- . Good design capability and reliability backed up by a team of skilled professionals able to provide application-oriented hardware, software and methodology development.
- . In-depth customer training and comprehensive documentation.
- . Toxic Chemical Laboratory capable of handling hazardous and carcinogenic compounds.
- . Analytical facilities - expertise in the field of gas chromatographic column technology enables preparation of both packed and open tubular capillary columns.
- . Organic Laboratory.
- . Elemental Analysis Laboratory.
- . Electronic Circuitry Development Laboratory.
- . Product testing facilities - experienced in testing vacuum systems involving cryogenics and ultra high vacuum.
- . Effective working arrangement with the Aerospace Institute Laboratory of the University of Toronto. Work is carried out in this laboratory on fundamental questions pertinent to TAGA® developments.

EXPERIENCE: Sciex sales of TAGA® 3000 and TAGA® 6000 MS/MS systems on an international basis include IBM, Xerox Corp, US Customs, National Research Council of Canada, Battelle (Edgewood Arsenal), Defense Research Establishment Valcartier, Defense Research Establishment Suffield, General Electric/New York State Environment, Ministry of Environment (Ontario), and Ministry of Defense (UK).

The company has developed methods for real-time detection of explosives, illicit drugs, and CW agents in the parts-per-trillion range. In addition, Sciex has participated in special consulting studies including those dealing with pre-collected sampling systems in the field or workspace.

The company received the 1978 Canada Enterprise Award. In 1980, Sciex received an IR-100 Award for developing the TAGA® 3000 as one of the 100 most significant technical products in 1979.

KEYWORDS: 4=Chemistry; 6=Computers; 7=Electronics; 9=Environment; 16=Security & Safety; 20=Miscellaneous; Mass Spectrometry=4, 9, 16; Research & Development=6, 7; Ion Physics=9, 20; Ion Molecule Chemistry=4; Contract Research=4, 7, 9; Computer Design=6; Fluid Dynamics=20; Vacuum Technology=20; Ultra-Trace Analysis=4, 9, 20; Electronics Design=7; Instruments=4; Testing=9; Mobile & Laboratory Based Analytical Services=4, 9, 20; Product Characterization=4; Quality Assurance=20; Professional Services=4, 6, 7, 9, 16, 20; Toxic Agent Detection=9, 16; CW Agent Detection=9, 16, 20; Explosives Detection=16; Drugs Detection=20; Trace Gas Detection=9; Chemical Agent Detection=9, 16, 20.

COMPANY: SCINTREX Ltd

CODE: SCX

ADDRESS: 222 Snidercroft Road
Concord, Ontario, Canada L4K 1B5

CONTACT: Dr. H Seigel, President - (416) 669-2280

HISTORY: Scintrex Ltd began as Sharpe Instruments Ltd in 1947 and was incorporated as Scintrex Ltd, a public Canadian owned company, in 1967.

CAPABILITY: The Contract Instrumentation Division of Scintrex began developing monitoring instrumentation in 1974 for CANDU nuclear power plants. Since then, the company has manufactured tritium monitors, reactivity control logic cabinets, shut-off rod logic modules, high radiation hand-held monitors and logic panels for safety shut-down systems. CANDU reactor operators in Ontario, Quebec, New Brunswick, Korea, and Argentina use this equipment.

The Exploration and Analytical Equipment Division of Scintrex is a major part of it's business. It includes the design, development and manufacture of geophysical and geochemical instruments for the mining industry, and analytical instruments for chemical laboratories. Over the years, geophysics has become the key exploration tool for discovering new mineral deposits. The steady depletion of surface ore bodies and consequent need to detect buried deposits have produced a growing dependence on geophysical methods. Scintrex is a leader in the design, development and manufacture of mining exploration equipment. Its products, services and skills have contributed directly to numerous major mineral discoveries in different parts of the world. Out of this experience, there is an expertise in developing portable analytical equipment for remote, on site chemical analyses. They are working on a toxic gas detection system using laser technology. This truck mounted sensor is being developed primarily for the detection of nitrous oxide.

<u>AVERAGE WORK FORCE:</u>	Electronic Engineers	- 14
	Mechanical Engineers	- 2
	Chemists	- 4
	Geophysicists	- 9
	Technicians	- 50
	Machinists	- 20
	Sales, Office Staff & Others	- 101

GROSS SALES: 1979 - \$ 9.0M
1980 - \$11.2M
1981 - \$12.5M
1982 - \$14.8M

PLANT SIZE: 46,000 sq ft (additional 20,000 sq ft projected)

EXPERIENCE: Scintrex has had experience with US Army (contracted to build prototype nuclear radiation monitoring systems); Ontario Hydro (contracted to supply hand-held radiation dosimeters for nuclear power plants); and other CANDU reactor users (contracted to build a variety of radiation monitoring devices).

KEYWORDS: 4=Chemistry; 7=Electronics; 8=Energy; 9=Environment;
14=Protective Equipment; Radiation Monitoring Systems=9, 14; Dosimeters=9,

14; Tritium Monitors=9, 14; Gamma Ray Monitors=9, 14; Beta Ray Monitors=9, 14;
Geophysical Equipment=8; Electromagnetics=7, 8; Magnetic=8; Gravity=8;
Geochemical Equipment=8; Atomic Absorption Spectrophotometers=4, 9;
Ultraviolet Fluorescence Systems=4; 9; Toxic Gas Detectors=9;
Hazardous Gas Detectors=9; Remote Sensing=9; Ordnance Detectors=4, 9, 14;
Trace Gas Detection=9.

REVISED: Aug 82.

COMPANY: SEAGOLD INDUSTRIES Corp

CODE: SEA

ADDRESS: 4008 Myrtle St
Burnaby, British Columbia, Canada V5C 4G2

CONTACT: Mr. Denis Walsh, Sales Manager - (604) 437- 4445

HISTORY: Seagold was formed in 1978 to carry out research related to reverse osmosis desalination. TDC Technology Development Corp, a jointly owned company of Teck Research Inc and CDC Ventures Inc, acquired controlling interest in Seagold Industries Corp in 1979. The company began commercial production in the fall of 1980.

CAPABILITY: Seagold manufactures a full line of reverse osmosis desalinators from a hand operated unit for emergency use in life-rafts, to motorized desalination systems for making up to 100,000 gallons of fresh water per day from sea water.

AVERAGE WORK FORCE:

PhDs	-	2
Engs	-	4
Others	-	12

GROSS SALES: 1980/1981 - \$0.3M
1981/1982 - \$1.0M (projected)

PLANT SIZE: 6,000 sq ft

EQUIPMENT: Precision machine shop; Recirculating seawater test-bed system; and Analytical laboratory.

EXPERIENCE: Seagold Industries Corp has contracted with the US Army (MERADCOM) for the development of an energy efficient pump, and with the David W Taylor Research Center (Bethesda, MD) for hand operated life-raft desalinators. They have also provided the desalinator for the Eureka Weather Station on Ellesmere Island and the desalination systems are currently being evaluated by the Canadian Navy on four different vessels.

KEYWORDS: 9=Environment; 16= Security & Safety; Reverse Osmosis=9; Desalination=9, 16; Evaporators=9; Distillers=9; Pumps=9; Seawater=9.

REVISED: Jul 82.

COMPANY: SED SYSTEMS Inc

CODE: SED

ADDRESS: P. O. Box 1464
Saskatoon, Saskatchewan, Canada S7K 3P7

CONTACT: Mr. D H Kjosness, Vice President - (306) 244-0976

HISTORY: SED Systems Inc is a high technology systems engineering and production company located in Saskatoon, Saskatchewan, Canada. They evolved from the Space Engineering Division of the University of Saskatchewan. Originally, their activities consisted of the design and construction of rocket payloads for upper atmospheric research. Since their incorporation as a private company, SED has pursued a development policy which has led them increasingly into commercial markets with innovative products derived from aerospace technology. SED was incorporated in 1972.

CAPABILITY: SED supplies a diverse range of products and services to three principal markets - aerospace, communications, and agricultural instrumentation. They are organized along functional lines to deliver products and services. The business areas are (SED functional groups identified in each case) - (1) projects (Advanced Systems Engineering Group) and, (2) products (Marketing Group, R&D Group, & Manufacturing and Materials Management Group). These groups are coordinated by a centralized corporate office. The major products and services offered in each area are:

Projects - Communications systems engineering; custom satellite communications earth stations; complete satellite telemetry tracking and command earth stations; satellite ground control equipment; customized telemetry and tracking systems; scientific instrumentation for use on rocket payloads or in the space shuttle; and payload design integration and test services.

Products - Agricultural instrumentation; TVRO systems and components; direct broadcast terminals and components; subsystems for satellite earth stations; and pulse and touch-tone automatic telephone dialers.

Diversification is one of SED's major strengths. A careful assessment of the range of the company's products and services demonstrates that they are based on a relatively narrow range of technologies that have been developed in depth. The specific technologies are highly complementary. Often, two or more technologies are embodied in the same product, thus allowing the penetration of highly diversified markets with innovative products resulting from knowledge acquired in other fields. Complementary technologies have also strengthened SED by permitting staff mobility in response to market fluctuations and to facilitate employee development.

AVERAGE WORK FORCE: Professionals - 90
Technicals - 210

GROSS SALES: No Data

PLANT SIZE: 76,000 sq ft

EQUIPMENT: SED has a variety of specialized facilities including - precision machine shop and chassis fabrication facility; metal finishing and painting

shop; computer systems, earth stations and payload integration facilities; microwave clean room; and commercial high volume production facility with production capability of 50,000 PCBs per year.

EXPERIENCE: SED experience in the space and defense areas include:

SPACE:

Payloads - Sounding rocket and balloon payloads (1965-present) (produced over 60, Canadian National Research Council); and Firewheel sub-satellite (1980 launch on Ariane), NRC (Max Planck Institute - Germany).

Mission Planning and Support - Communications Technology Satellite - CTS or Hermes (1970-1976) [planned attitude acquisition phase, designed ground control station and developed software, Canadian Department of Communication (DOC)].

Satellite Telemetry, Tracking and Command Stations - ANIK A (TAC station for A2 (1972), Telesat Canada); ANIK C/ANIK D (transportable tracking station - located in Guam (1982), Hughes Aircraft Co); and LANDSAT/GOES (1972-present) [Canadian tracking station, Canadian Center for Remote Sensing (CCRS)].

Ground Control Equipment - ANIK C, ANIK D, SBS and INTELSAT V (1978-1982) (variety of equipment (50) including command generators and upconverters and telemetry displays, Hughes Aircraft Co).

Communications Earth Terminals - A wide variety of over 200 terminals including low cost 4 and 12 GHz TV receive only, and 2 way fixed and transportable terminals (4/6 and 12/14 GHz) (1974-present).

Satellite Systems Test Sets - ANIK C/SBS (12/14 GHz computerized payload test and integration support unit, Hughes Aircraft Co, and DOC); and ANIK D - 4/6 GHz (as for ANIK C, SPAR Aerospace and DOC) (1978-1981).

Computer Systems - LANDSAT, GOES (1978) (data collection platform processor (DCP), visible and infrared spin scan radiometer processor (VISSR), Canadian Atmospheric Environment Services and CCRS).

DEFENSE:

Digital Switches - NORAD Joint surveillance System (1979-1981) (digital switches to handle up to 84 channels of digitized radar data, Hughes Aircraft Co); and Miscellaneous Digital Switches (1981-present) (as for JSS above, Hughes Aircraft Co).

Satellite Control Centers - SARSAT Canadian Mission Control Center (1981-1982) (installed at Trenton, Ontario as part of Canada's contribution to the international Search and Rescue Satellite (SARSAT) Program, provides control and monitoring capability for the entire Canadian SARSAT system, Department of National Defense).

Tracking Systems - Air Defense Aerial Target Tracking System (1981-present) (developing a tracking antenna, telemetry receiving system

for use with target drones at the Defense Research Establishment Suffield in Alberta, Department of National Defense).

Communications Systems - Project Eureka (1981-present) (designed, developed and installed a full, 2-way satellite communications ground system in Ottawa and Eureka to provide a data link for the DND (Project Hurricane), and Telesat Canada).

Canadian Patrol Frigate - SED is the system designer for the External and Internal Communications Systems for the CPF in the Program Definition Phase, Sperry Inc (1981-present).

Meteorological Systems - Canadian Patrol Frigate (1981-present) (SED is the system designer for the Meteorological System for the CPF in the Program Definition Phase, Sperry Inc).

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics; 9=Environment; 15=Radar; 17=Software Services; 18=Space Systems; Ground Stations=7, 18; Radio Communications Gear=5; Telephone Communications=5; Weather Radar=9, 15; Design to Requirements=17; Simulations Programs=17; Communications Systems=18; Instrumentation=18; Systems Studies=18; Satellite Communications Ground Stations=18; Satellite Telemetry Tracking Stations=18; Ground Control Equipment=18; Payload Design=18; Payload Test Services=18; Computer Systems=6, 18; Digital Switches=15; Aerial Target Tracking System=1.

REVISED: Aug 82.

COMPANY: SHARP SPECIAL SYSTEMS (Ottawa)
I. P. SHARP ASSOCIATES Ltd

CODE: IPS

ADDRESS: 265 Carling Ave, Suite #600
Ottawa, Ontario, Canada K1S 2E1

CONTACT: Mr. W W Bradbury, Mgr, Special Systems (Ottawa) - (613) 236-9942

HISTORY: I. P. Sharp Associates Ltd is a Canadian owned company incorporated in 1964. The corporate headquarters is located in Toronto. Sharp Special Systems is a division of I. P. Sharp that began operation in 1973. All of the company's minicomputer-related activities are amalgamated in the division. Wholly owned subsidiaries of this Canadian company are located in Australia, Austria, Belgium, Denmark, France, the Far East, Germany, Italy, Mexico, The Netherlands, Norway, Sweden, Switzerland, the UK, and the US. The company has twelve Canadian locations in six provinces. There are nineteen US locations in twelve states and Washington, DC.

CAPABILITY: I. P. Sharp is a computer software company specializing in - (1) Provision of timesharing service called SHARP APL; (2) Development of software to handle projects ranging from large database applications to small real-time monitor and control systems; and (3) Research and development of software tools to aid in the production of secure systems.

SHARP APL is offered in both interactive and batch modes and can be used at your own premises, using a variety of terminals, via a telephone connection. Each user has 256 kilobyte work-space that may contain both functions and data. Any number of work-spaces may be stored on disk for later retrieval. The file system is based on the principles of shared direct access and total security.

Development of turnkey computer systems now represents the major portion of the Special Systems activities. However, they continue to offer a wide range of services, including:

- . Project Management
- . Facilities Management
- . Feasibility Studies
- . System Specification and Design
- . Hardware Evaluation, Selection and Acquisition
- . Design and Selection of Communications Facilities
- . System Operational Audits
- . Contract Programming
- . Complete Turnkey systems

AVERAGE WORK FORCE: Total - 400 (Professionals plus Support Staff)

GROSS SALES: 1979 - \$24M
1980 - \$35M
1981 - \$50M

PLANT SIZE: 10,000 sq ft (Special Systems Office Space - all locations)

EQUIPMENT: 2 x Amdahl 480/V8; 1 x VAX 11/780; and n x PDP 11/34.

EXPERIENCE: I. P. Sharp has experience in the following areas:

Timesharing - Using SHARP APL, many multi-national companies and governments access private and public data bases in Socio/Economic, Financial, Commodities, Airline Schedules, and Natural Resources.

Process Monitoring and Control - Mail Handling Systems for Canada Post Office; Plant Monitoring System for General Electric Company; Process Monitoring Systems for Atomic Energy of Canada; Radar Control for Canadian Department of National Defense; and Command and Control System for DDH280 for Canadian Department of National Defense.

Real-Time Information Display - Operational Information Display System for airports administered by Canadian Ministry of Transport; MAX-PAK, a micro film information system developed for Illinois State Police; Aviation Communication Measurement System, an airborne communications monitor for Canadian Ministry of Transport; and Schipol Airport Information System for the Amsterdam airport.

Communications - The SHARPnet, designed and built by I. P. Sharp Associates Ltd to facilitate access to SHARP APL; and X.25 compatible front-end processors and Network Interface Machines for Canadian Department of National Defense.

Research and Development - Specification of secure Database Management Systems for USAF project Guardian; Implementation of Euclid compiler jointly funded by the US Defense Advanced Research Projects Agency (DARPA) and Canadian Department of National Defense; Front End Security Monitor for Canadian Department of National Defense; Formal Verification Methodology for Canadian Department of National Defense; and Integrated Verification System for the US Navy.

KEYWORDS: 5=Communications; 6=Computers; 7=Electronics; 16=Security & Safety; 17=Software Services; 20=Miscellaneous; Facility Management=20; Data Acquisition=17; Data Processing=17; Design to Requirements=17; Graphics=17; Displays=17; Computer Security=16; Measurement & Control Systems=7; Timesharing Service=17; Real-Time Monitor Systems=17; Real-Time Control Systems=17; Turnkey Computer Systems=6, 17; Project Management=6, 17; Feasibility Studies=6, 17; System Specification=6, 17; System Design=6, 17; Hardware Evaluation=6; Radar Control Systems=6, 17; Command & Control Systems=6, 17; Information Displays=17; Interface Systems=5.

REVISED: Nov 82.

COMPANY: SHERRITT GORDON MINES Ltd

CODE: SGM

ADDRESS: Fort Saskatchewan, Alberta, Canada T8L 2P2

CONTACT: Mr. Herbert Veltman, Dir, Sherritt Research Center - (403) 998-6911

HISTORY: Sherritt is a highly diversified company with a US subsidiary located in Portland, Oregon (Sherritt Fertilizers Inc). Sherritt was incorporated in 1927 as a mining company. In 1954, their processing plant at Fort Saskatchewan was opened. Located at this latter site is the Sherritt Research Center which is their R&D arm.

CAPABILITY: Besides mining copper, zinc & precious metals, and refining nickel & cobalt, Sherritt Gordon carries out R&D at their Research Center in the area of powder metallurgy. Sherritt is active in developing dispersion strength alloys and abrasible seals for turbine engines. They are currently expanding their research activities to include cobalt rare earth magnets, wear resistant materials, and continuous casting.

During 1981, Sherritt's development work continued in wear-resistant materials and a new composite powder for abrasible seal application. These items are now in commercial production. They are also engaged in a program to produce new powders for higher strength cobalt-samarium magnets. Research has continued on the development of composite powders for thermal spraying applications in jet engine seals and for wear-resistant coatings.

AVERAGE WORK FORCE:

Total (Research)	-	91
PhDs	-	13
MSSs	-	3
BSSs	-	21
Others	-	54

GROSS SALES: (R&D Only)
1980 - \$3.5M
1981 - \$2.8M

EQUIPMENT: Sherritt's Research Center is well equipped for process research in hydrometallurgy and product research. This includes autoclaves, solvent extraction and ion exchange equipment, standard chemical laboratory equipment, and an analytical laboratory. Also included are powder presses, sintering furnaces, rolling mills, vacuum induction melting equipment, and flame & plasma spray guns. Physical testing equipment includes tensile testing, stress rupture, wear resistance, metallography, transmission and scanning electron microscopes, electron microprobe, and x-ray diffraction.

EXPERIENCE: A large portion of Sherritt's total metal roles go to the US which includes fabrication metal products, such as dispersion strengthened nickel and composite powders for turbine engines. The products, which may be used in military aircraft, are sold to engine manufacturers. Sherritt is interested in doing business with the USAF when the research area is consistent with their research objectives. Research and development projects have been carried under USAF contracts in the late 1960s and early 1970s. These contracts were in the area of dispersion strengthened nickel-chromium alloys. The research specifically dealt with improved oxidation resistance and mechanical properties.

KEYWORDS: 1=Aircraft; 4=Chemistry; 12=Machining; 20=Miscellaneous;
Engine Components=1; Engine Systems=1; Powder Metallurgy=4, 12;
Precision Casting=12; Specialty Alloys=4, 12; Dispersion Strength Alloys=1, 4,
12; Alloys=1, 4, 12; Abradable Seals=1, 4, 12; Rare Earth Magnets=20;
Wear Resistant Materials=1, 4; Continuous Casting=12;
Cobalt-Samarium Magnets=20; Thermal Spraying=1, 4; Magnets=20; Casting=12.

REVISED: Oct 82.

COMPANY: SIMTRON Ltd

CODE: SIM

ADDRESS: 494 The Queensway, Unit #1
Peterborough, Ontario, Canada K9J 7L9

CONTACT: Mr. L T Legris, Sales Manager - (705) 743-6903

HISTORY: Simtron Ltd was formed in 1976 to design, manufacture and service electronic products for the communications, air, maritime and ground transportation markets. In 1982, Simtron Ltd was acquired by Dowty Equipment of Canada Ltd. Dowty specializes in the design, development, manufacturing, certifications testing and overhaul of landing gear, flight control systems and related aerospace and marine equipment.

CAPABILITY: Simtron's activities are divided into three major areas:

Aerospace - The design and manufacture of aircraft landing gear steering (steer by wire). This equipment is presently being delivered to Dowty Equipment Ltd for inclusion in their systems on the DeHavilland-8 and the Canadair-601 aircraft.

Multiplex Alarm Systems - Simtron has developed a data acquisition system called Multiplex 490 alarm system that represents a major improvement over existing equipment in the market place. Systems are now installed and working in several major Canadian locations. Ongoing R&D and development activities are proceeding on this equipment.

Build to Print - Simtron is engaged in building to print for a number of large corporations. Products vary from printed circuit boards to specialized test equipment. The in-house insurance confidence of Simtron offers these customers the additional security and service of custom design and when required properly engineered substitutions. Built products include printed circuit board assembly, wire harnessing, cabinet assembly and testing.

<u>AVERAGE WORK FORCE:</u>	R&D	- 3
	Engineers	- 2
	Technicians	- 1
	Production	- 59
	Others	- 9

GROSS SALES: 1980 - \$687,958
1981 - \$811,332

PLANT SIZE: 10,000 sq ft (capability to expand to 25,000 sq ft)

EXPERIENCE: See Capability Section.

KEYWORDS: 1=Aircraft; 7=Electronics; 19=Testing/Test Equipment;
Landing Gear Steering Systems=1; Steer By Wire Systems=1; Data Acquisition=7;
Build To Print=7; PC Board Fabrication=7; Test Equipment=19;
Specialized Test Equipment=19; Wiring Harness Fabrication=7; Cabinets=7;
Cabinet Testing=7, 19.

REVISED: Nov 82.

COMPANY: SLACAN
Division of Slater Steel Industries Ltd

CODE: SLA

ADDRESS: 681 King St W
Hamilton, Ontario, Canada L8N 3E7

CONTACT: Mr. Wendell MacDonald, Manager OEM Sales - (519) 455-6320

HISTORY: Slacan was incorporated in the Province of Ontario in 1962.

CAPABILITY: Slacan is an operating division of Slater Steel Industries Ltd with its head office and manufacturing facilities located in Hamilton, Ontario. They are the largest Pole Line Hardware manufacturer in Canada, providing more than 2,000 different items for the electrical, transmission and communications markets. The division's product lines are engineering orientated. They claim a reputation for excellence of design, high quality of manufacture, and long service in the field. Their business areas of interest are - aluminum castings, steel forgings, and steel stampings. They operate under quality control levels outlined in CSA 2299.3 and under Military Specifications MIL-C-6021, Class 2A, 2B Grade B and D for castings. Specific capabilities are outlined below:

Aluminum Castings - permanent mold up to 50 pounds; sand mold up to 150 pounds; Feron, CO₂ and shell cores; and material poured 125, 135, 234, 432, 6377, Almag 35, B226, A357, etc. Reference: All aluminum castings for the ballistic fire control computer developed by Computing Devices for the US Army M-1 main battle tank.

Stampings/Steel - a total of 85 units comprised of open back inclines to 135 ton capacity, straight sided single action presses to 200 ton capacity, double acting deep draw to 300 ton punch and 200 ton blank holder capacity, hydraulic brakes to 400 ton capacity with 14 ft bed including 2 ft horn. The above equipped with air clutches, brakes and cushions.

AVERAGE WORK FORCE: Total - 250

GROSS SALES: No Data

PLANT SIZE: 190,000 sq ft (manufacturing area)

EQUIPMENT: Slacan maintains the following equipment:

Forging Equipment - Four board hammers up to 2,000 pounds capacity; One electro-hydraulic hammer 4,000 pounds capacity; One forging press 700 tons capacity; Three hot headers 2" capacity; One hot header 1.5" capacity; and various trim presses and furnaces.

Finishing Equipment - Machining limited, however, includes milling, turning, drilling, threading and tapping. Other facilities include welding, cleaning, painting, hot dip galvanizing, heat-treating (Steel and Aluminum), and tool engineering.

EXPERIENCE: No specific information was given on experience except for Slacan's work with Computing Devices Co (Aluminum castings for the ballistic

fire control computer for the M-1 main battle Tank). Customers include private industries in the US and Canada.

KEYWORDS: 12=Machining; Castings=12, Aluminum Castings=12; Stamping=12; Steel Stampings=12; Forgings=12; Steel Forgings=12.

REVISED: Nov 82.

COMPANY: SPAR AEROSPACE Ltd

CODE: SPA

ADDRESS: Corporate Headquarters
Royal Bank Plaza
Suite #3690, South Tower
P. O. Box 83
Toronto, Ontario M5J 2J2

Space & Electronics Group
Remote Manipulator Systems Division
1700 Ormont Drive
Weston, Ontario, Canada M9L 2W7

Satellite Systems Division
Aerospace & Communications Systems Division
21025 Trans-Canada Highway
Ste-Anne-de-Bellevue, Quebec, Canada H9X 3R2

Defense Systems Division
P. O. Box 13050
Kanata, Ontario, Canada K2K 1X3

Mechanical & Electrical Group
Gears & Transmissions Division
Repair & Overhaul Division
825 Caledonia Road
Toronto, Ontario, Canada M6B 3X8

The Copter Shop
1190 McTavish Road, Northeast
Calgary, Alberta, Canada T2K 7G6

Northway-Gestalt Corporation
1450 O'Connor Drive
Toronto, Ontario, Canada M4B 2V2

CONTACT: Mr. B R Machum, Dir, Gov't Relations & Marketing Support - (613)
563-0230, 77 Metcalf St, Suite #212, Ottawa, Ontario, Canada,
K1P 5L6.

HISTORY: Spar Aerospace Ltd, a Canadian owned company, commenced operations as a public company in Jan 1968, following the acquisition of the Special Products & Applied Research (SPAR) Division of The de Havilland Aircraft Company of Canada Ltd.

In 1960, they bought the assets of York Gears Ltd, and in 1972 acquired Astro Research Corporation of California. In 1977, the Government and Commercial Systems Division of RCA Ltd was acquired, and in the same year Spar purchased certain assets of the space electronics manufacturing unit of Northern Telecom Ltd. In 1978, the Copter Shop of Calgary, Alberta, Canada, was acquired.

In 1981, the company acquired Northway-Gestalt Corporation which was founded in 1946 and is the largest mapping company in Canada. Northway-Gestalt acquired Aerial Graphics of Colorado Inc of Denver in July 1980 in order to establish an operating base in the US.

CAPABILITY: The company is engaged in the design, development, manufacture and servicing of systems and products for the aerospace, communications, remote sensing, aviation and mapping markets.

Aerospace - Spar's largest single project to date is the development of the Remote Manipulator System (RMS) for the US Space Transportation System. The first RMS was produced in Canada under an agreement between the National Research Council of Canada (NRCC) and the National Aeronautics & Space Administration (NASA). Spar was the prime contractor to NRCC for the design, development and manufacture of this flight system under contracts valued at about \$95 million. In 1979, NASA placed a contract with the Canadian Commercial Corporation for Spar to build three additional systems at a cost of some \$60 million. Delivery of these systems to NASA is scheduled for 1982, 1983 and 1984. The RMS comprises a 15 meter (50 ft) long mechanical arm with joints similar to a human shoulder, elbow and wrist. It is operated by an astronaut to deploy satellites and other space payloads from the Space Shuttle's cargo bay, and to retrieve them for on-board servicing or return to earth. The RMS is capable of handling payloads weighing up to 30,000 kilograms (65,000 lbs).

The company is also working on several non-space applications of the advanced manipulator system. In 1980, Ontario Hydro awarded Spar a contract to perform design studies on the use of remote manipulator systems in the maintenance of nuclear reactors. Programs to test manipulators for under-water applications and to adapt them to medical use for handicapped people have also been undertaken.

Through Astro Research Corporation, Spar designs and develops light weight portable structures for space and ground applications. These include the patented STEM product line and the Astromast deployable structures which support large solar-cell arrays on satellites. Astro is currently supplying support structures and systems for the Large Space Telescope, a joint project of NASA and the European Space Agency (ESA).

Communications - Spar is the principle supplier in Canada of satellite communications systems which include satellites and satellite sub-systems and land-based earth stations. The design and fabrication of structures and payloads for the following Canadian satellites which are now in orbit was done by Spar - the Alouette I and II, the ISIS I and II, the Anik A series, and the Hermes satellite. For the Anik B, Spar produced the payload.

Hughes Aircraft Company of Los Angeles in 1978 awarded Spar a \$20 million sub-contract for work on the Anik C satellite scheduled to be launched in 1982. The project comprises certain design functions and the manufacture and testing of communications payload systems - transponders and antennas - power, attitude and stability controls, spacecraft structures and thermal controls.

In 1979, Spar was awarded a \$78.6 million prime contract by Telesat Canada Ltd, to supply two 24-channel Anik D communication satellites - the first such prime contract to be won by a Canadian company. For this program, the Federal Government has enlarged the facilities at the David

Florida Laboratory near Ottawa, providing a capability for the integration and testing of large satellites which up to now has not been available in this country. RCA Astro Electronics Division in 1980 granted the company a \$2.2 million contract to supply the antenna system for the Satcom E commercial satellite which is expected to be launched in 1981.

The company manufactures satellite earth stations and equipment and microwave components for markets in Canada and abroad. Major current projects consist of a \$17 million contract from Ghana for an earth station and related components, and a \$3.6 million contract from Embratel of Brazil to supply communications equipment for earth stations. To date, Spar has supplied 82 earth stations to 14 different countries.

Remote Sensing - the company is a leader in the field of remote heat sensing technology, having worked for more than 15 years to develop a unique passive infrared surveillance system which detects ships, missiles and aircraft for defense and navigation purposes. In 1977, a Spar-developed system was tested by the Canadian Navy on a destroyer and a similar system was evaluated on land and sea by the US Navy in 1979. Following the success of these trials, the Canadian and US Governments have been engaged in negotiations to facilitate, on a joint basis, the final pre-production development phase of the program.

Aviation Services - the manufacture of gears and transmissions has been a basic part of the operations since 1969. Spar designs, manufactures, assembles and services gear boxes and transmissions for engines in jet aircraft and helicopters. It also manufactures gears for the RMS, the joints of which comprise large and intricate gearboxes.

The company produces accessory gearboxes for General Electric's J85-21 (F-5E/F aircraft) and the T700 (Black Hawk, Sea Hawk, AAH and Bell 214ST helicopters) engines, manufactures tail rotor and intermediate gear boxes and main rotor shafts for the Sikorsky S.76 helicopter.

Spar fabricated the transmission and other components for the Boeing-Vertol CH-46 Chinook helicopter, and also produced the transmissions and gears for the Westland Lynx helicopters (UK) and the gearbox components for the Puma helicopter made by Aerospatiale of France.

In 1980, General Electric's aircraft engine group awarded contracts to Spar for more than \$10 million to produce gearboxes and components for several aircraft and helicopter engines, including the new J79-17X engine development program.

The company provides repair and overhaul services (R&O) for a wide range of military and commercial aircraft instruments and mechanical components, servicing such customers as Nordair, Pacific Western Airlines, Aeromexico and Quebecair. Through the Copter Shop, Spar performs full maintenance services on helicopters. R&O services cover electrical, oxygen, navigational, auto pilot, hydraulic, and air conditioning systems, constant speed drives, accessory gearboxes and components of electrical, flight control and heating systems.

A large part of the business is derived from agreements with 17 aircraft equipment manufacturers which have appointed Spar a Canadian "service station" for their products.

In 1980, Spar and Sperry Inc, a subsidiary of Sperry Corporation of New York, agreed to establish "a continuing business relationship" to pursue contracts for "the life-cycle support of military and commercial aircraft and ships". This business combination has the technology and skills to service the new generation of computerized aircraft instruments and systems.

Mapping Services - Northway-Gestalt acquires, analyzes and displays information of the earth's terrain on conventional graphic maps and converts these maps to computer language - digital mapping. The company's major technological asset is the Gestalt automated mapping system of which the unique Gestalt Photo Mapper (GPM) is the major component.

The GPM using electronics and optics scans aerial photographs, collects up to 700,000 height elevations per orthophoto, analyzes and correlates these data in a computer, and produces Gestalt Orthophotos - highly accurate photographs in which the distortions in the terrain caused by aerial photography have been mathematically corrected; and Digital Elevation Model (DEMs) - computer-produced maps on mechanical tape which contain precise elevation data essential to the accurate plotting of contours, slopes and horizontal and vertical measurements.

Northway-Gestalt sells about one-half of its services to clients in the private sector including forestry, surveying, natural resources, utility and engineering companies. The balance is sold to governments and their agencies for use in resource evaluation, setting environmental standards, and for land use studies.

Research and Development - R&D has been an important activity since the company's inception and has contributed greatly to the success of Spar. In the past five years, more than \$13 million has been invested in R&D, including grants and contributions from governments. About 20% of the time of Spar's engineering staff is spent on R&D projects. The company maintains its own specialized engineering laboratories which have direct access to large-capacity scientific computers.

AVERAGE WORK FORCE: S&E and Technologists - 600
Others - 1400

GROSS SALES: 1979 - \$108.8M
1980 - \$127.7M
1981 - \$130-\$140M

PLANT SIZE: Spar maintains facilities at Toronto (2); Ste-Anne-de-Bellevue, Quebec; Kanata, Ontario; Calgary (The Copter Shop); and Carpinteria, California (Astro Research). Northway-Gestalt has facilities in Toronto; Dartmouth, Nova Scotia; Vancouver, BC; and Denver, Colorado. In total, these facilities occupy about 630,000 sq ft.

EXPERIENCE: Spar's services, systems and products are marketed to governments and their agencies; commercial airlines, manufacturers of aircraft, aircraft engines and parts; and engineering & industrial companies. Some of these contracts are outlined in detail in the Capability Section. Countries include Australia, Canada, and the US, and many in Western Europe, Asia, and Africa. Most work is performed under design, development or production contract, or a combination of the three. Development contracts cover design work - including production of prototype, while production contracts include all forms of manufacturing.

Spar's sales to the US total about 20%, of which about 8% are to the US military (less than 1% to the USAF). Most US military sales are indirect through sub-contract to US contractors for aircraft equipment in the electro-mechanical field.

KEYWORDS: 1=Aircraft; 3=Avionics; 5=Communications; 7=Electronics; 18=Space Systems; Structures=1, 18, 20; Mechanical A/s=18; Communication=18; Ground Stations=5, 7, 18; Antennas=5, 7, 18; Engine Components=1; Controls=1, 18; Systems=5, 7, 18; Remote Sensing=20; Repair & Overhaul=1, 3, 7; Mapping=9, 17, 20; Microwave Components=5, 7, 18; Airframe Components=1; Infrared Instrumentation=7, 10, 20; Aerial Surveys=9, 20.

REVISED: May 82.

COMPANY: SPARTON OF CANADA Ltd

CODE: SOC

ADDRESS: P. O. Box 5125, Terminal A
100 Elm St
London, Ontario, Canada N6A 4N2

CONTACT: Mr. L Staszak, Vice President - (519) 455-6320

HISTORY: Sparton, incorporated under Federal charter in 1930, is a wholly owned subsidiary of Sparton Corp, Jackson, MI.

CAPABILITY: Sparton specializes in the development, engineering, and manufacture of specialized electronic products for the military, industrial, and Original Equipment Manufacture (OEM) markets. Their R&D activities include development of a directional command active sonobuoy, new improved low noise passive sonobuoy, a low noise hydrophone; and switched & ferro-resonant power supplies.

Sparton's Engineering Department staff covers professional disciplines of electrical/electronic engineering, mechanical engineering, physics, flow dynamics, and hydroacoustics. They are experienced in the preparation and management of engineering objects from proposal through to implementation (development, specifications, testing, and production).

Sparton of Canada Ltd is a qualified producer meeting the requirements of DND 1015 and US MIL-9858A Quality Assurance Programs. There is a resident military QC detachment on the premises. Sparton is cleared for DSS Industrial Security for projects up to SECRET classification. Current product lines are active and passive sonobuoys for military customers, and heavy duty low voltage regulated power supplies for large computer systems.

AVERAGE WORK FORCE:

Production	- 150 - 200
Engineering Dept	- PhD - 1
	MSc - 1
	Phys - 1
	Engs - 7
	Tech - 19
	Others - 10

GROSS SALES: 1979 - \$ 8.0M
1980 - \$ 7.3M
1981 - \$17.0M
1982 - \$ 9.6M

PLANT SIZE: 170,000 sq ft

EQUIPMENT: Sparton's engineering facilities include fully equipped laboratories, hydrodynamic test tank, access to CAD programs, computer terminal access to CDC CYBER 73/16, DEC System 10, and GE MK3 System (IBM 3033).

EXPERIENCE: Sparton is a supplier of passive sonobuoys to the Canadian Government; supplier of omni-directional Range Only (RO) active sonobuoys to the Canadian Government and to other overseas users; sole source supplier of

RO active sonobuoys (AN/SSQ-47B) to the US Navy and to other overseas users; OEM supplier of two types of regulated power supplies to NCR, Waterloo, Ontario; responsible for development of Canadian Command Active Sonobuoy System for Canadian Government; in 1981 commenced development of Canadian Directional Command Active Sonobuoy System (DICANCAS) for Canadian Government; and also in 1981 established the capability for the design, development, testing, and manufacture of heavy duty depth compensated underwater Ring Shell Sound Projectors. Applications for the latter device are anti-submarine warfare (ASW) crew training, dipping sonar, and scientific investigations of ocean sound propagation characteristics or sound detection systems.

KEYWORDS: 6=Computers; 7=Electronics; 20=Miscellaneous; Sonobuoys=7, 20; Hydrophones=7, 20; Power Supplies=6, 7; Active Sonobuoys=7; 20; Passive Sonobuoys=7, 20; Command Active Sonobuoys=7, 20; Underwater Ring Shell Sound Projectors=7, 20; Acoustic Sensing=7; Environmental Sensors=7; Geophysics=7; ASW=20.

REVISED: Oct 82.

COMPANY: SPERRY UNIVAC DEFENSE SYSTEMS
Division of Sperry Canada Inc

CODE: SUD

ADDRESS: 200 Saulteaux Crescent
Winnipeg, Manitoba, Canada R3J 3W3

CONTACT: Mr. G R Smith, Dir, Canadian Operations - (204) 888-4222

HISTORY: Sperry Univac's Winnipeg Manufacturing Plant was established in 1977 as the first facility of the Defense Systems Division of Sperry Univac to be located outside the Continental US. The establishment of this plant was a direct result of the procurement policy of the Canadian Department of National Defense as it related to the CP-140 Aurora Patrol Aircraft. The company operates exclusively at the Tier 3 level of the industry. The initial plant charter was to assemble components for the Univac CP-140 Computer which is the heart of the sophisticated computer technology developed for submarine detection. This computer is also deployed on the US Navy P3C and S3A Aircraft.

A Systems Engineering and Marketing facility was established in Ottawa in December 1980 to assist in the integration of the Engineering Systems requirements for the Canadian Patrol Frigate Program with hardware design, software development, manufacturing, and system integration efforts in Winnipeg.

CAPABILITY: The charter of the Winnipeg Plant has expanded from assembly to complete design, software development, testing, and system integration of its own product line. Presently, the Winnipeg plant is engaged in assembly and test of coil wound products, core memory arrays, power supplies, magnetic tape transports, maintenance consoles, switches, printed circuit assemblies, harnesses, and the start up of a product mandated Microcomputer.

The rapid expansion of their areas of endeavor required a new facility which started operation in April 1981. The new plant has the latest in high technology manufacturing, test and office facilities, and is certified by the Department of National Defense as a manufacturer and repair facility of electronic equipment. The final test area contains environmental chambers that meet the complete range of military specifications and are large enough to accommodate entire computer and avionics systems. Random vibration capabilities will be installed to meet the workmanship screen required on all new Canadian and international avionics military procurements. Sperry Univac recently started development of the AN/UYC-501 (V) SHINPADS (Shipboard Integrated Processing and Display System), a product conceived by the Canadian Forces for use on the new Canadian Patrol Frigates.

AVERAGE WORK FORCE: Engineers - 27
Manufacturing - 105
Administrative - 23

GROSS SALES: 1980 - \$1.5M
1981 - \$5.0M
1982 - \$10.0M
1983 - \$12.0M (projected)

PLANT SIZE: 40,000 sq ft (Winnipeg Facility)
5,000 sq ft (Ottawa Facility)

EQUIPMENT: Sperry employs such equipment as Environmental Test Chamber; Random Vibration; Automated Card and Final Test Systems; Flow Solder; Component Lead Formers; Semi-Auto Dip Insertion; and Static Controlled Work Stations.

EXPERIENCE: Sperry Univac Defense Systems is a major supplier of high technology, reliable and ruggedized information handling products and systems. Customers include the US military, US industry, and International military procurements.

KEYWORDS: 1=Aircraft; 6=Computers; 7=Electronics; 15=Radar;
17=Software Services; 20=Miscellaneous; Cockpit Displays=1, 7;
Computer Parts=6; Measurement & Control Systems=7;
Multi-Layered Board Assemblies=7; Pre-Wired Board Assemblies=7;
PC Board Design=7; PC Board Fabrication=7; Power Supplies=7;
Repair & Overhaul=7; Video Display Systems=7, 20; Surveillance/Navigation=15;
Core Wound Products=7; Core Memory Arrays=7; Magnetic Tape Transports=7;
Maintenance Consoles=7; Harnesses=7; Switches=7;
Information Handling Products=7; Navigation=15; Microcomputer=6;
Software Services=17; Integrated Processing & Display Systems=17, 20.

REVISED: Oct 82.

COMPANY: SPILSBURY COMMUNICATIONS Ltd

CODE: SCS

ADDRESS: 120 East Cordova St
Vancouver, British Columbia, Canada V6A 1L1

CONTACT: R E Macpherson, International Sales Manager - (604) 684-4131

HISTORY: Spilsbury is a Canadian owned company incorporated in 1941. A branch office is located in Halifax, Nova Scotia. There are no US subsidiaries.

CAPABILITY: Spilsbury specializes in radiotelephone equipment, antennas, and navigational aids for long range frontier and coastal marine communications. The company develops and manufactures HF single sideband radio communication equipment for land and marine use, fixed and mobile. They are also concerned with the overall concept of providing a system of communications rather than with the manufacture of specific units. One of the major areas of innovation in this field has been the design of a unique series of antennas which increases the effective communicating power of a radio by ten to fifteen times over a conventional installation. These Spilsbury, center-loaded, variable tuned, HF, whip, antennas are used in portable, mobile and fixed service on land, sea and air. In addition to the above, Spilsbury manufactures VHF/FM radiotelephone equipment for mobile and fixed station land or marine use. Other specialized equipment includes low frequency, non-directional beacon systems for medium range aeronautical or marine navigation installations.

AVERAGE WORK FORCE:

Professional (Technical)	- 16
General Assembly	- 20
Others	- 29

GROSS SALES:

1980	- \$3.5M
1981	- \$4.0M
1982	- \$5.0M (Forecast)

PLANT SIZE: 18,000 sq ft

EXPERIENCE: Spilsbury equipment is used in over 50 countries including the US.

KEYWORDS: 5=Communications; Radiotelephone Equipment=5; Antennas=5; Navigational Aids=5; HF Radios=5; Single Sideband Radios=5; Fixed=5; Mobile=5; Communications Systems=5; HF Whip Antennas=5; Variable Tuned Antennas=5; Center-Loaded Antennas=5; VHF/FM=5; Beacon Systems=5; Low Frequency Beacon Systems=5; Non-Directional Beacon Systems=5; Antennas=5.

REVISED: Oct 82.

COMPANY: SYSTEMHOUSE Ltd

CODE: SYS

ADDRESS: Royal Bank Center
90 Sparks St, 4th Floor
Ottawa, Ontario, Canada K1P 6K2

CONTACT: Mr. John Owens, Asst to the Senior VP - (613) 234-6544

HISTORY: Systemhouse is a public Canadian company incorporated in mid-1974. The head office is located in downtown Ottawa while branch offices are located across Canada (Vancouver, Edmonton, Calgary, Regina, Winnipeg, Toronto, London, Montreal, Halifax and Frederickton) and the US (Boston, New York, Chicago, Cleveland, St Louis, Los Angeles, San Francisco, San Diego), with the US subsidiary located at 9900 Main St, Suite 401, Fairfax, Virginia, telephone - 703-385-0970.

CAPABILITY: In the areas of consulting and custom system development, Systemhouse has a broad range of clients in the public and private sectors. Not constrained to any manufacturers' equipment, the Services Division provides solutions on a range of mini, micro, and mainframe systems. Areas of concentration are - financial management systems, social services management systems, health care, videotex (Telidon), office automation, building energy management, interactive data base, computer communications, and distributed processing.

Systemhouse began the development of proprietary products in 1977, and currently offers packaged solutions in the areas of distribution (order entry and processing, sales analysis, budgeting and general accounting), manufacturing (order entry, sales analysis, inventory control, materials management, job scheduling, and materials processing), health care (financial management, and control of all functions related to the pre-admission, discharge and transfer activities of patients), information management (on-line data entry, correction and retrieval), photogrammetry & cartography (applicable to topographic maps and nautical charts, with an interactive graphics capability and wide range of peripherals) and computer assisted drafting for use by architectural and engineering firms. The company recently released to the marketplace its Resource Analysis and Mapping System (RAMS) which manages and graphically displays information relating to a region's natural resources.

Systemhouse has now formalized its commitment to Research and Development. In addition to the development of products in the above areas, R&D projects are under way in the area of energy management systems - communications controllers, office automation, microcomputers, and development productivity techniques.

Systemhouse also provides a custom engineering function through its Manufacturing and Integration Division. This division's activities are both internal for other divisions of the company and external where M&I is contracted by microelectronics firms for specialized manufacturing and testing.

AVERAGE WORK FORCE: 1,200 employees (80% professional)

GROSS SALES: 1981 - \$30.5M
1982 - \$50.0M (Est)

EXPERIENCE: Systemhouse clientele includes Canadian Federal and Provincial Governments, the Australian Government, and private industry. Approximately 25% of the sales are to the US.

KEYWORDS: 5=Communications; 6=Computers; 8=Energy; 10=Image Processing & Optics; 17=Software Services; 20=Miscellaneous; Turnkey Systems=6; Videotex (Teledon)=10; Photogrammetry=10; Cartography=10; Office Automation=6, 20; Financial=17; Computer Systems=5, 6; Controller=5; Energy Management=8, 17; Data Base=17; Drafting=6.

REVISED: Mar 82.

COMPANY: TECHNIMECA Ltd

CODE: TEC

ADDRESS: 380 Montee de Liesse
St Laurent
Montreal, Quebec, Canada H4T 1N8

CONTACT: Mr. G Isabey, Vice President - (514) 739-3193
(Mr. M Martinez - Alternate)

HISTORY: Technimeca Ltd is a Canadian owned company incorporated in 1972 with no other Canadian divisions or US subsidiaries.

CAPABILITY: Technimeca Ltd specializes in precision machining. They primarily manufacture parts for aerospace, electronics, and commercial industries. Small and medium size parts are manufactured and assembled from solid bar, forgings and castings, to military specifications or specific customer requirements. They have the facilities to work with aluminum, magnesium, brass, plastics, steels, stainless steels, copper, beryllium copper, nickel and titanium. Other materials have been machined utilizing various special techniques. Their inspection facility includes equipment such as a coordinate measuring machine, optical comparator, hardness tester, checkers for surface roughness and gears, and various types of gages and measuring devices. Because of the innovative manufacturing techniques required in the precision parts industry, selected employees undergo a comprehensive and ongoing training program.

AVERAGE WORK FORCE: Total - 36

GROSS SALES: 1980 - \$1.0M
1981 - \$1.2M
1982 - \$1.5M (Estimated)

PLANT SIZE: 20,000 sq ft

EQUIPMENT: Technimeca's manufacturing capability is supported by equipment for turning, machining (numerical control), jig boring, gear cutting, milling, duplicating, grinding, drilling, and bending. Other miscellaneous equipment common to machining facilities are present.

EXPERIENCE: Technimeca is interested in bringing in work from the US and appears to be capable of carrying out work for the USAF. Past and present customers include Pratt & Whitney, Rolls Royce Canada, General Electric (US), plus other companies from the US and Canada.

KEYWORDS: 12=Machining; Precision Machining=12; Aerospace Parts=12, Electronics Parts=12; Forgings=12; Castings=12; Aluminum=12; Magnesium=12; Brass=12; Plastics=12; Steels=12; Stainless Steels=12; Copper=12; Beryllium Copper=12; Nickel=12; Titanium=12.

REVISED: Jul 82.

COMPANY: TEKLOGIX Inc

CODE: TEK

ADDRESS: 1199 Fewster Dr
Mississauga, Ontario, Canada L4W 2A9

CONTACT: Mr. J R Coutts, President - (416) 625-5673

HISTORY: Incorporated in 1967, Teklogix Inc is Canadian owned, privately held and all shares are owned by active participants. The company was formed to provide special hardware and software for minicomputer users and has evolved with this industry.

CAPABILITY: Special hardware and software systems for process control, material handling, machine control, plant and warehouse control, and digital data communications systems. Products include digital radio links for remote control of cranes and locomotives, radio linked mobile data terminals for use aboard forklift trucks, etc. Primary capabilities are in systems design and engineering, development, production and related R&D. Normal Spec Level - CSA level 4. Mil Spec capability in selected areas.

AVERAGE WORK FORCE: 30 (including Engineers, Mathematicians, Programmers, Technicians, Production, and Support Staff)

GROSS SALES: \$1M to \$1.5M (recent past)
\$2M (forecast for FY 1983)

PLANT SIZE: 12,000 sq ft (additional 6,000 sq ft available)

EQUIPMENT: Normal electronic lab and production equipment, including communication test sets. In-house data processing equipment used for systems design, development, and support include PDP11/34, PDP11/05 (two), PDP11/23, PDP8 and all normal peripheral equipment.

EXPERIENCE: Sort and conveyor control systems for the Canada Post office in Calgary, Toronto, Montreal and Halifax; Steel plant control systems for LASCO (Canada), Irish Steel Ltd (Cork, Ireland), Chaparral Steel (Midlothian, Texas), and Raritan River Steel Co (New Jersey); area paging control system for Bell telephone; mining process control systems for International Nickel, Noranda and Falconbridge; warehouse and material handling systems for Kellogg-Salada, Dylex and Dominion Stores; Warehouse automation systems for Digital Equipment Corp (Phoenix), and Defense Logistics Agency (Richmond).

KEYWORDS: 5=Communications; 6=Computers; 17=Software Services;
20=Miscellaneous; Automation=20; Hardware=5, 6; Software=6,
Process Control=17; Digital=5; Mobile Data Design=5, 6, 17, 20; Development=5,
6, 17, 20.

REVISED: Mar 82.

COMPANY: TRACKER INDUSTRIES Ltd

CODE: TIL

ADDRESS: 246 Jane St
Toronto, Ontario, Canada M6S 3Z1

(Mailing Address)
P. O. Box 1094, Station A
Toronto, Ontario, Canada M5W 1G6

CONTACT: Mr. Lou Fedyna, President - (416) 762-8744

HISTORY: Tracker Industries was incorporated in 1974. It is a wholly owned Canadian company with no other Canadian locations.

CAPABILITY: Tracker is engaged in custom design and prototyping (R&D) of analog and digital electronic circuits. Specifically, the company R&D areas include microprocessor applications engineering (hardware and software) and programming. Microprocessors include the 68000, 6809, 8080, and 8085. They have experience with the following computer languages - Assembly, Basic, Pascal, Forth, and Fortran. Programming applications have been in the areas of environmental, biomedical, avionics, data communications, data acquisition, and monitor/control systems. Their design and prototype work has been primarily directed to hand-held portable equipment. In the area of network systems (X.25, HDLC, SDLC and local area network design communications), the company is generally involved in the interfacing areas.

AVERAGE WORK FORCE: Engineers - 3
Others - 2

GROSS SALES: \$0.15M

PLANT SIZE: 1,000 sq ft (expandable to 3,000 sq ft)

EXPERIENCE: Tracker Industries' clients include General Motors of Canada, Bell Canada, other corporations, universities, and the Federal & Provincial governments. Products include data communication networks, data terminals, and local area networks (interfacing, systems design).

KEYWORDS: 5=Communications; 7=Electronics; 17=Software Services;
Consulting=7; Solid State Devices=7; Microprocessors=7; Interfacing=5;
Network Systems=5; Programming=17; Environmental Programming=17;
Avionics Programming=17; Data Communications=17; Data Acquisition=17;
Monitoring Systems=17; Control Systems=17; Data Terminals=17;
Systems Design=5, 7; Telephone Communications=5; Design to Requirements=17;
Transportation Control Systems=17; Analog=5, 7; Digital=5, 7.

REVISED: Oct 82.

COMPANY: UDT INDUSTRIES Inc

CODE: UDT

ADDRESS: 2125 East, St-Catherine
Montreal, Quebec, Canada H2K 2H9

CONTACT: Mr. Alberto Stagnaro, Purchasing Agent - (514) 526-9454

HISTORY: UDT was incorporated in 1942 under the name of Universal Die & Tool. Name was changed to UDT Industries Inc in 1975 to reflect more accurately their machine shop business. The company is Canadian owned and there are no other Canadian or US subsidiaries.

CAPABILITY: UDT's major product is machined parts ranging from light-medium to hard core items, such as fittings, splice plates, hinges, bulkheads, slat-tracts, spars, dog legs, spar caps, leg assemblies, etc., made from plate stock, forgings, extrusions, aluminum alloys, steels, titanium, etc. CNC and conventional equipment are utilized.

Aluminum alloys heat treating electrical air furnace is part of UDT's capability, 5 ft diameter by 18 ft high, it is continuously performing quench & age hardening of major structural parts for McDonnell Douglas & Lockheed Aircraft from AL-AL 7075 T 411 & 2014 T 411 condition F to T6 or T73 condition. UDT works to MIL Q9858 A and DND 1016. Tolerances are maintained as per customer's requirements.

<u>AVERAGE WORK FORCE:</u>	Engineers	- 1
	Inspectors	- 5
	Machinists	- 40
	Others	- 24

GROSS SALES: 1979 - \$3.6M
1980 - \$4.4M

PLANT SIZE: 81,000 sq ft

EQUIPMENT: NC equipment includes vertical machining centers, horizontal machining center, vertical profiling milling machines, vertical profiler bed type (3 & 4 axis).

EXPERIENCE: UDT's customers include McDonnell Douglas Canada Ltd (DC 9 & DC 10), Canadair (from T33 to Challenger), Enheat, DeHavilland Aircraft, Fleet Industries (Lockheed Product), NATO, USAF, CCC, DND, Rohr, Research & Development Canada (Propulsion Pod), and ITT Gilfillan (Antenna Radar).

KEYWORDS: 12=Machining; Precision Machining=12; Metalworking=12; Heat Treating=12; Specialized Coating=12; Coating=12; Parts=12.

REVISED: Oct 82.

COMPANY: ULTRA LASERTECH Inc

CODE: ULI

ADDRESS: 6415-2 Viscount Road
Mississauga, Ontario, Canada L4V 1K8

CONTACT: Dr R A Crane, Director, Science & Technology - (416) 677-8091

HISTORY: Ultra Lasertech is a small high technology company incorporated in 1979 with a laser technology base and licensing derived from RCA. There are no other Canadian divisions and no US subsidiaries.

CAPABILITY: Ultra Lasertech is engaged in the design and manufacture of custom CO₂ lasers and wave guide lasers. They are involved in R&D associated with laser photoacoustics, laser spectroscopy, and laser communications & radar. Other areas of expertise include remote sensing, pollution detection, ultra high power laser modeling and design, and laser applications. Their product line includes sealed, continuous wave, isotopic CO₂ lasers; tuneable CO₂ lasers; a CO₂ laser optoacoustic detector; industrial type sealed CO₂ lasers; laser power supplies; and mirror mounts.

AVERAGE WORK FORCE: Total - 6 full-time
3 part-time

GROSS SALES: 1979 - \$313K
1980 - \$300K
1981 - \$422K

PLANT SIZE: 3,000 sq ft (R&D Laboratories)
800 sq ft (Production Facility)

EXPERIENCE: Since their start in 1979, Ultra Lasertech has been engaged in the development of a laser optoacoustic trace gas analyzer, a commercial laser cavity enclosure, and an industrial CO₂ laser. Other projects have included determining the laser optoacoustic signatures of PCBs, developing a tuneable sealed ¹³CO₂ laser system, a sealed ¹⁴CO₂ laser tube, and a balanced dual spectrophone chamber and measuring water vapor absorption at isotopic CO₂ laser wavelengths. Their optoacoustic trace gas analyzer is being designed specifically to measure nitric acid vapor, although it is applicable to a large number of contaminants of environmental concern. Their analyzer is being designed to detect the acidic vapor down to the lower limit of less than 1 ppb for field operational use. The present status is detection at 10 ppb. Other gases studied during development include several freons, sulfur hexafluoride, ethylene, ammonia, butane, some explosives, PCBs, Jet A fuel, and several other hydrocarbons. It is anticipated this technique will be suitable for detection of hydrazine.

KEYWORDS: 9=Environment; 11=Lasers; 15=Radar; CO2 Lasers=11;
Waveguide Lasers=11; Photoacoustics=11; Spectroscopy=11; Communications=11;
Remote Sensing=9; Pollution Detection=9; Ultra High Power Modeling=11;
Ultra High Power Design=11; Applications=11; Sealed CO2=11;
Continuous Wave CO2=11; Tuneable CO2=11; Isotopic CO2=11;
CO2 Optoacoustic Detector=11; Mirror Mounts=11;
Optoacoustic Trace Gas Analyzer=9, 11; Cavity Enclosure=11;

Trace Gas Detection=9; Toxic Gas Detection=9; Power Supplies=11;
Hazardous Gas Detection=9; Modeling=11; Design=11; Radar=15.

REVISED: Oct 82.

COMPANY: URBAN TRANSPORTATION DEVELOPMENT CORP Ltd

CODE: UTD

ADDRESS: 2 St Clair Ave W
Toronto, Ontario, Canada M4V 1L7

CONTACT: Mr. Ed Brezina, Manager, Gov't & Public Affairs - (416) 961-9569

HISTORY: The Urban Transportation Development Corp Ltd (UTDC) was established in 1973 to design, develop and market new transit equipment and systems. Other Canadian locations include Project Offices in Hamilton, Ontario and Vancouver, British Columbia; the Transit Development Center in Kingston, Ontario; and another office in Wychwood (Toronto), Ontario. The company maintains an office in the US - Arlington, VA, UTDC (USA) Inc. UTDC is Canadian owned.

CAPABILITY: As mentioned above UTDC's main objective is to develop new, rail-based transit systems. Some of their vehicles/systems are described below:

Intermediate Capacity Transit System - an automated system that has the capability of transporting in excess of 25,000 people per hour.

Canadian Light Rail Vehicle - a single ended, 4 axle rigid vehicle capable of operating singly or in trains of up to six units. Propulsion by two, 220-HP motors, each driving two axles (440 HP per car). Solid state chopper control with blended, regenerative braking.

All UTDC research and development in the ground transportation area is carried out at their Kingston facility, UTDC Research and Development Ltd. All projects are product delivery programs, and all exploitation of technology advances and designs already acquired, are carried out by Metro Canada Ltd. This division, located in Kingston, manufactures and installs all transit systems and related hardware products. It includes the Transit Development Center. New R&D areas will be the development of hydrogen storage and fuel systems to be equipped on two demonstration transit buses.

AVERAGE WORK FORCE: Total number not provided; however, 45.4% are Engineers or have PhDs, and 45.5% have college/university degrees.

GROSS SALES: No Data

PLANT SIZE: 40,000 sq ft (under construction - Mill Haven, Ontario)

EQUIPMENT: Training facilities, propulsion development laboratories, transit test track, SELTRAC-Vehicle command control and communication system, and energy test lab.

EXPERIENCE: Major customers include - Toronto Transit Commission; San Francisco Municipal Railway; Transport Canada; Royal Commission on Electric Power Planning; Olaco Ltd; Ontario Northland Railroad; California Department of Transportation; Department of Transportation (US) - Santa Clara County, California; and MBTA-Massachusetts Bay Transportation Authority.

Some major projects include:

Steerable Truck Retrofit Design - a preliminary design to modify an existing heavy rail transit truck to make it steerable for the US DOT.

Transit Management Advisory Services - a study (including recommendations) of San Francisco Municipal Railway Maintenance Procedures, and the implementation of improvements for the city of San Francisco.

LRT Training Program - an Operations Training Program for San Francisco's new underground light rail transit service for the city of San Francisco.

Transportation Advisory Services - evaluate and recommend ways and means to upgrade rail commuter services between San Francisco and San Jose for the California DOT.

Santa Clara County Life Cycle Costing Demonstration Project - a demonstration and validation of life cycle cost procurement methodology for the purchase of transit coaches for Santa Clara County, California.

Canadian Light Rail Vehicles - design, develop and delivery of 191 Light Rail Vehicles for the Toronto Transit Commission.

Hydrogen Powered Buses - develop hydrogen storage and fuel systems, and equip two demonstration transit buses to use hydrogen for the Ministry of Energy, Province of Ontario.

Composite Flywheel Materials - a development program for the design and testing of composite materials for flywheels for the National Research Council of Canada.

Rotary Powered Steerable Rail Truck - preliminary design of a steerable rail truck with AC rotary propulsion for Transport Canada.

KEYWORDS: 20= Miscellaneous; Ground Transportation=20; Transit Systems=20; Fuel Storage Systems=20; Hydrogen Storage Systems=20; Trucks=20.

REVISED: Jul 82.

COMPANY: VARIAN CANADA Inc

CODE: VAR

ADDRESS: Varian Canada Microwave Division
45 River Drive
Georgetown, Ontario, Canada L7G 2J4

CONTACT: Mr. O J Caldarelli, Marketing Manager - (416) 457-4130

HISTORY: Varian Canada Inc is a Canadian corporation, a wholly owned subsidiary of Varian Associates of Palo Alto, CA. Varian Canada Inc was established in 1955. It was formed at that time primarily to supply microwave tubes for Canadian military requirements. As the company grew, it set out to develop new products and new markets. Today the Canadian company's sales are approximately 75% for export and 25% for domestic consumption. Its products are split nearly evenly between electron tubes and electronic equipment.

CAPABILITY: The major product areas of Varian Canada Inc are:

Travelling Waves Tubes: The company produces a line of travelling wave tubes aimed primarily at line-of-sight microwave communication applications. These tubes cover frequencies ranging from 2 to 15 GHz and power levels up to 40 watts. The capability exists for the design or customizing of tubes to meet the customer's specific requirements. Full qualification and test capabilities for these tubes are also available.

Reflex Klystrons: Varian Millimeter Reflex Klystrons are available in a complete frequency range from 30 to 220 GHz and output power ranges from 5 to 800 mW. The tubes are typically utilized in communications and radar systems for airborne and ground based applications. They are also utilized in plasma diagnostics, spectroscopy, meteorological instrumentation, and other experimental applications.

Power Klystrons: The company manufactures a series of power klystrons used primarily for satellite earth stations and troposcatter applications. These are available in frequencies of 4, 6, and 14 GHz and power levels up to 3 kilowatts. These tubes are available with various channel tuner configurations including a microprocessor controlled automatic channel tuner. Full test and repair facilities exist for these tubes. The manufacturing and test facilities are such that other power tubes of differing frequencies and powers can also be manufactured and tested.

Extended Interaction Klystrons (Very High Frequency Microwave Oscillators and Amplifiers): This series of products was developed and is continuing to be expanded in the Canadian facility. These products address the very high frequency ranges for microwave applications with frequencies ranging from 18 up to 280 GHz. The EIK's are rugged, light, compact, and are capable of generating medium RF power levels in either continuous or pulsed modes. The CW power levels of these klystrons range from 1 kilowatt at 18 GHz to 1 watt at 280 GHz. Peak power outputs range from 1 kilowatt at 35 GHz to 60 watts at 220 GHz. They are well suited as RF power sources in a wide range of applications such as - Military Radar (fire control, surveillance, beam rider, track, etc); Secure Communications Systems; Radar Modelling; Fusion Diagnostics; Plasma

Heating; Satellite Communications; and Radio Astronomy. The company is equipped to develop, manufacture, and test EIKs to specific customer needs.

Power Supplies: The company designs and manufactures a complete series of power supplies for all of the travelling wave tubes and various other electron tubes supplied by Varian. In addition, the company has extensive development, manufacturing, and testing capabilities for complex power supplies of both high and low voltage outputs, DC or AC input, multiple outputs, stringent noise and regulation requirements, and specialized shapes and sizes. Power ranges that have been previously designed and supplied vary from a few watts up to 30 kilowatts with voltages ranging up to 30 kV. The power supplies are designed and manufactured for both military and commercial applications.

Satellite Communications Power Amplifiers (Military and Commercial): The company has developed and manufactured a series of high powered commercial amplifiers for satellite communications. The amplifiers are available in frequency ranges of 6 and 14 GHz and power levels up to 3 kW. Extensive options as well as design capabilities exist to permit tailoring to individual customer requirements. These amplifiers consist of the power klystron, the associated power supplies, cabinetry, necessary waveguide, and control circuitry. A military high power amplifier has also been designed and manufactured by the company. This particular unit was used for military satellite communications and had power capabilities of 10 kW. It consisted of a complete subsystem including the electron tube, power supply, control circuitry, waveguide, liquid cooling circuit consisting of a water to air heat exchanger, and purification loop.

Millimeter Wave Subsystems: The company is developing a series of power supplies and pulsed, specifically designed to power its line of Extended Interaction Klystrons. It will offer these subsystems from existing designs or customize them to meet customer needs. Systems will be available to both commercial and military specifications.

AVERAGE WORK FORCE: Total - 400

GROSS SALES: \$30.0M

PLANT SIZE: 100,000 sq ft (2 Facilities)

EQUIPMENT: The company has extensive equipment utilized in the manufacture of electron tubes. These include furnaces, vacuum sealing facilities, clean rooms, laser welding equipment, and microwave test facilities. They also have the general capability to manufacture electronic equipment including, in particular, the capability for testing microwave subsystems and power supplies. Extensive machine shop capabilities for very delicate work exist within the facility with the equipment best described as "watchmaker accuracy". Facilities also exist for qualifications and testing to MIL/Commercial shock, vibration, and environmental requirements. In-house transformer capabilities exist to support their power supply group.

EXPERIENCE: Varian has extensive experience working with original equipment manufacturers of telecommunications equipment, specifically microwave communications. It is a supplier to all major North American manufacturers of line of sight microwave radios. The company has been involved in various development programs for power supplies and other electronic subsystems against the customer's specifications or internal requirements.

Varian has undertaken military programs with the largest single program being of approximately \$6.0M value and of two and a half years duration. The company has also manufactured components for space applications to NASA specifications.

Clientele include the various agencies and laboratories of the Canadian and US Governments, US research institutions as well as private industry throughout North America.

KEYWORDS: 7=Electronics; 18=Space Systems; Solid State Devices=7; Travelling Wave Tubes=7; Klystrons=7; Reflex Klystrons=7; Power Klystrons=7; Extended Interaction Klystrons=7; Power Supplies=7; Power Amplifiers=7; Satellite Communications Power Amplifiers=7, 18; Pulsers=7; Millimeter Wave Subsystems=7; Waveguides=7; Amplifiers=7; Amplifier Subsystems=7, 18; Control Circuitry=7; Cabinets=7.

REVISED: Nov 82.

COMPANY: VICTRIX Ltd

CODE: VIC

ADDRESS: Box 1807
Guelph, Ontario, Canada N1H 7A1

OTTAWA OFFICE
29 Pellan Crescent
Kanata, Ontario, Canada K2K 1J7
C B Dowden, Engineering Manager - (613) 592-3888

CONTACT: Mr. H Lawry, Dir of Marketing - (519) 836-1480

HISTORY: Incorporated in 1975 (100% Canadian owned).

CAPABILITY: Approximately 80% of their R&D and manufacturing is for the Canadian Department of National Defense. Typical engineering projects include:

- . Technical investigations and engineering services to DND on marine weapon systems drives and controls.
- . Engineering services to industry on control systems for machinery and large winches.
- . Engineering services to industry on sound and vibration problems in gear systems.
- . Design and prototype fabrication of 20 KW vertical axis windmill.
- . Designed and developed 1.2 m plastic parabolic antenna for 11.6 Hz satellite receiving.
- . Developed production techniques for fabrication of outdoor unit to house LNA of satellite receiving antenna.
- . Investigated dielectric feed horn problems and developed modifications
- . Engineering services on avionics flight surfaces control systems.

Small manufacturing capability include the following items:

- . Amplifiers, reactors, special transformers, & RF coils.
- . Fiberglass microwave dish antennas.
- . Small gears and gear reducer assemblies.
- . Extrusion and molding of miscellaneous plastic and rubber parts.
- . Aircraft smoke signal markers pyrotechnics.
- . Cable assemblies.
- . Marine projectile line throwing devices.
- . Inflatable mast antennas.
- . Marine weapon system drive and controls

Victrix also has an R&O capability for radar duplexers, precision electronic components and power supplies.

AVERAGE WORK FORCE: 1 Senior Scientist (Electronics)
1 Mechanical Engineer
1 Telecommunications Engineer
2 Technologists
2 Technicians
1 Machinist
10 - 30 Production People

GROSS SALES: 1981 - \$2.68M
1982 - \$4.7M (projected)

PLANT SIZE: 13,000 sq ft (3 locations)

EQUIPMENT: Machining, vacuum molding, fiberglass layup and forming, & electronic laboratory to 20 GHz measurement, and pyrotechnic manufacturing.

EXPERIENCE: DND - Marine Weapon System Drive Controls
- Aircraft Smoke Signal Markers
- Marine Line Throwing Device
- Portable Antenna Masts

DOC - Satellite M/W Parabolic Dishes

KEYWORDS: 1=Aircraft; 4=Chemistry; 8=Energy; 12=Machining;
16=Security & Safety; 18=Space Systems; 19=Testing/Test Equipment;
Ground Station Antennas=18; Pyrotechnics=1, 4, 16; Smoke Markers=1, 4, 16;
Portable Antenna Masts (Surface)=18; Weapon System Controls=19; Windmills=8;
Electronics=19; Plastic Fabrication=12.

REVISED: May 82.

COMPANY: VORTEK INDUSTRIES Ltd

CODE: VOR

ADDRESS: 1820 Pandora Street
Vancouver, British Columbia, Canada V5L 1M5

CONTACT: Dr G G Albach, President - (604) 251-2451

HISTORY: Vortek is a private Canadian company, incorporated in 1975 in the Province of British Columbia, with no other branches or US subsidiaries.

CAPABILITY: Vortek specializes in the manufacture and development of ultra-powerful arc lamps and related optical systems. The lamps operate at input powers of up to 125,000 watts, using a patented internal cooling method. Originally developed for outdoor floodlighting, the lamps have proven to be an excellent light source for solar simulation and industrial processes. Vortek also operates a high-power plasma arc laboratory. New product designs are tested prior to production, and radiation experiments are conducted for clients on a contract basis.

AVERAGE WORK FORCE: PhDs - 3
Engineer - 1
Others - 5

GROSS SALES: 1980 - \$1M
1981 - No Data

PLANT SIZE: 4,000 sq ft

EQUIPMENT: The company has developed sophisticated fabrication techniques for liquid-cooled tungsten electrodes, and operates the only commercial tungsten electrode fabrication facility in Canada. Engineering of large, high-power optical systems is done using an in-house Data General Computer System. The company fabricates liquid-cooled optical assemblies, and maintains a large area rhodium metal plating facility for reflector production.

EXPERIENCE: The company is an OEM supplier of ultra-power arc lamps and optics to Eaton/Nova in Boston, for use in semiconductor annealing equipment. Most recent Canadian contract was, installation of Large Area Solar Simulator in the Canadian National Solar Testing Facility in Toronto, Canada.

KEYWORDS: 8=Energy; 9=Environment; 10=Image Processing & Optics;
20=Miscellaneous; Arc Lamps=8, 9; Tungsten Electrodes=8, 20; Solar
Simulation=9; Metal Plating=8, 9, 10; Optical Processing=10; Plasma Arc=8;
Optics=8, 9, 10; High Intensity Light Source=8.

REVISED: Mar 82.

COMPANY: WESTECH SYSTEMS Ltd

CODE: WSL

ADDRESS: 12852 - 141 Street
Edmonton, Alberta, Canada T5L 4N8

CONTACT: Mr Robert Betteridge, Sales Mgr - (403) 452-8450

HISTORY: A Canadian-owned, high-technology, telecommunications company formed in late 1978 by Alberta Government Telephones of Edmonton, International Systcoms Ltd, and AES Data Ltd, both of Montreal, Quebec. The original mission of Westech was to design and supply a new, fully-automatic, Mobile Telephone System for use in Alberta, Canada.

CAPABILITY: Based on modular design, their primary product - the Aurora System, is a high-capacity, frequency transparent system, which can utilize an existing telephone network.

The system provides for full duplex operation, call queing, automatic mobile tracking between cells, remote mobile disable, out of range indication, call forwarding, rural radio capabilities, and can offer priority-class service.

Although Aurora was originally designed as a Mobile Telephone System, a great deal of genuine interest has been shown to adjust the many inherent features into large private radio systems, which often require vehicle tracking and instant contact with staff members.

Westech also offers Custom System Design, System Consulting Services and Project Management Services.

AVERAGE WORK FORCE:

Engineers	-	10
Technical	-	18
Others	-	10

GROSS SALES: 1982 - \$11 to \$15M

PLANT SIZE: 12,000 sq ft (R&D and Manufacturing)

EXPERIENCE: Westech is evolving from an R&D company to a complete Systems-House, offering complete high technology systems.

KEYWORDS: 5=Communications; 7=Electronics; Radio=5, 7; Consulting=5, 7; Systems Design=5, 7; Project Management=5, 7.

REVISED: Mar 82.

COMPANY: WESTERN INSTRUMENTS Ltd

CODE: WIL

ADDRESS: 5308 - 72 A Avenue
P. O. Box 8729, Station L
Edmonton, Alberta, Canada T6C 4J5

CONTACT: Alexander Palynchuk, President - (403) 465-6527

HISTORY: Western Instruments Ltd was incorporated in 1966 and has carried on an active business since its inception. They were an offshoot of some technical developments created, tested, marketed, and manufactured in part by the two prime movers of the corporation, Alexander Palynchuk and Richard W Henderson.

CAPABILITY: Western Instruments Ltd manufactures ultrasonic non-destructive test systems for welded steel pipe. These systems are engineered, designed and built in their facilities in Edmonton. They are built to provide testing facilities to meet API, CSA, ASTM, and other specifications. As a testing system manufacturer, they are uniquely experienced and knowledgeable of metallurgy and its relationship to defects and metals processing. Research and development is an ongoing concern with regard to the systems and the use of ultrasonics in testing and control of quality and various industrial applications.

Other involvements of the company in manufacturing have to do with use of hydraulics, particularly hydrostatics, and pumpjacks which are currently in the process of being patented. Research and development is ongoing in this area as well.

The organization has capability in the electronics service and PC Board area as well. They use this knowledge for the design of unique application equipment in the areas of industrial ultrasonic sensing systems, application of computer controlled systems for applications, production facilities, etc.

Western Instruments Ltd is a combination of capabilities and research and development, production systems engineering and problem analysis leaning primarily to the electronics, infrared, laser type technology, hydraulics, pneumatics, hydraulics and metallurgy with a leaning towards inventing and application of conceptual ideas.

Western Instruments Ltd has developed a special process for pipe and tube bending which results in thickening of tube wall only - no thinning.

AVERAGE WORK FORCE: Professionals - 4
Consultants - 10 (Canada & US)

GROSS SALES: No Data

PLANT SIZE: 8,000 sq ft (Office & Plant)

EQUIPMENT: Western Instruments Ltd employs a universal milling machine; drill press; lathe scopes; MICOM 2000; and SuperPET Commodore SP9000 with Dot Matrix printer and dual disk drive.

EXPERIENCE: Western Instruments' ultrasonic installation customers include commercial companies in Canada, the US, and Mexico. The list of companies and description of installations is too long for inclusion in this document, but can be made available upon request.

KEYWORDS: 4=Chemistry; 7=Electronics; 19=Testing/Test Equipment; 20=Miscellaneous; Ultrasonics=7, 19, 20; Hydraulics=20; Pneumatics=20; Test Systems=19, 20; X-Ray=20; Infrared=20; Conceptual Application=20; Troubleshooters=20; Metallurgy=4; Non-Destructive Test Systems=19, 20.

REVISED: Nov 82.

COMPANY: WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT

CODE: WNR

ADDRESS: Pinawa, Manitoba, Canada R0E 1L0

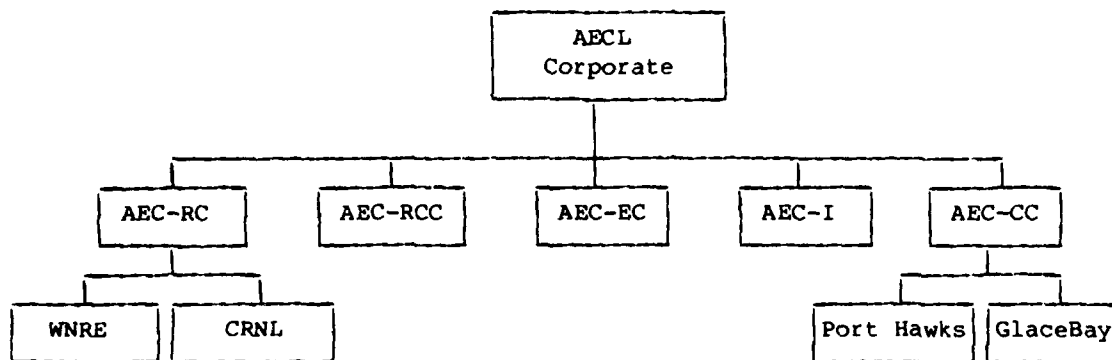
CONTACT: Mr. Raymond O Sochaski, Mgr, Commercial Ops Office - (204) 753-2311

HISTORY: The Whiteshell Nuclear Research Establishment (WNRE) came into being in 1963 for the purpose of developing the organic cooled nuclear power reactor concept. WNRE is part of the Atomic Energy of Canada Research Company (AEC-RC), which in turn is a part of Atomic Energy of Canada Ltd (AECL). The latter is a crown corporation of the Government of Canada.

Canada's nuclear program had its beginning during the Second World War when a team of Allied scientists was assembled in Montreal for work related to the development of atomic weapons. With the end of the war, the Canadian effort was redirected, and since then all work on atomic energy has been concerned with peaceful uses.

The program was initially administered by the National Research Council of Canada, but by 1952 it had expanded so much it was placed under a new, specialized organization (AECL). In the fall of 1979, a commercial Operations Office was established at WNRE for the purpose of marketing site services, products and transferring technology.

The following is a breakdown of the AECL structure:



AEC-RC (AEC Research Co) - Head office is in Ottawa with sites at Chalk River, Ontario and Pinawa, Manitoba.

AEC-RCC (AEC Radiochemical Co) - Head office and manufacturing facilities in Ottawa, Ontario with offices scattered in foreign countries.

AEC-EC (AEC Engineering Co) - Head office, engineering offices, and labs at Toronto, Ontario with engineering offices in Montreal, Quebec.

AEC-I (AEC International Co) - Head office in Toronto, Ontario with offices scattered in foreign countries.

AEC-CC (AEC Chemical Co) - Head office and engineering offices at Ottawa, Ontario with plants at Glace Bay and Port Hawkesbury, Nova Scotia.

CAPABILITY: WNRE is an R&D site. It performs fundamental and applied research, develops processes, products and components, and has a large staff of experienced people in most disciplines and trades. Its strongest capability is touted as the ability to undertake the role of innovator, perform the necessary R&D work, build and prove the prototype or pilot plant, and commercialize the concept. They are currently conducting a large scale study involving the combustion and explosion of H₂/Air/H₂O mixtures. They are also active in monitoring the presence and effects of radiation fields. Another ongoing study involves the transport of radionuclides in the biosphere and in man-made structures.

Keywords that describe their capability:

Research & Development (R&D)	Reactor Facilities	Electrochemistry
Computer Code Development	Nuclear	Fluid Dynamics
Materials Characterization	Irradiations	Safeguards Risk
Non-destructive Testing	Chemical Analysis	Analysis
Professional Services	Contract Research	Corrosion
Colloidal Chemistry	Neutron Activation	Health Physics
Surface Chemistry	Metallurgical	Radiation
Medical Biophysics	Reactors	Environment
Derived Release Limits	Isotopes	Pathways
Biological Environment	Radiation Shielding	Analysis
Radioactive Wastes	Physics	Tailings
Chemical Processes	Chemistry	Metallography
Electronics, Nuclear	Thermal Analysis	Disposal Trace
Instruments, Nuclear	Hydraulics	Analysis
Separation Processes	Nuclear Design	Vitrification
Fracture Mechanics	Mathematics	Detonation
Mechanical Testing	ASME Codes	Qual Assurance
Materials Testing		

AVERAGE WORK FORCE:

Professional	- 235
Technical	- 250
Clerical	- 180
Prevailing Rate	- 235

GROSS SALES:

1980/1981 - Annual Budget	- \$47M
Gov't Appropriation	- \$42M
Commercial Revenues	- \$ 5M
1981/1982 - Annual Budget	- \$50M
Gov't Appropriation	- \$44M
Commercial Revenues	- \$6.5M

PLANT SIZE: Approximately 10 major buildings which house R&D facilities - a research reactor (WR-1); engineering offices; machine, construction and maintenance work shops; administrative offices; protective services; fire department; and stores and warehousing. Very rough area of all facilities is 150,000m².

EQUIPMENT: Facilities are geared to nuclear R&D and have the following unique items:

- . Research reactor - (WR-1 organic cooled, the only operational organic

reactor in the world).

- . Irradiation facilities, i.e., loops, neutron activation facilities, nuclear fuel, materials, corrosion and component test facilities.
- . Good design capability, CAD system available backed up by experienced staff and large library of relevant computer codes.
- . Analytical facilities - unique capability for surface characterization and trace element measurements.
- . Metallurgical and mechanical testing facilities - experience in testing ferrous and non-ferrous metals, ceramics, glasses, rocks, and composites.
- . Hot cell facilities capable of handling 10^6 Curies of radioactive material.
- . Fabrication capabilities.
- . Biophysical laboratories.
- . Environmental laboratories and field facilities.
- . The site consists of 40 Km² of land area.
- . Gamma irradiators, Van de Graaff and neutron generator facilities.
- . Combustion test facilities to study detonation characteristics on steam, air, hydrogen mixtures.

EXPERIENCE: AECL has been in existence for approximately 35 years. During this time, it has developed the CANDU-pressurized heavy water reactor system. It has helped to commercialize the radioisotope industry in the medical, pharmaceutical and industrial fields; developed and commercialized the heavy water industry and is currently the world's largest producer of this commodity. In addition, AECL has been instrumental in developing the Canadian nuclear fuel industry and has played a large part in developing the US nuclear fuel design for both military and civilian reactors. It has also played a major role in developing and commercializing zirconium alloys for the nuclear industry. AECL's major assets are experienced staff and state-of-the-arts facilities and equipment.

KEYWORDS: 4=Chemistry; 8=Energy; 9=Environment; 12=Machining; 17=Software Services; 19=Testing/Test Equipment; 20=Miscellaneous; Custom Research=4; General Chemistry=4; Nuclear Reactors=8; Nuclear Instrumentation=8; Nuclear Simulation=8; Pollution Sensing & Analysis=9; Pollution Control=9; Environmental Analysis=9; Testing=9, 19; Metallurgy=12, 19; Design to Requirements=17; Non-Destructive Testing=19; Instrumentation=19; Environmental Programs=9; Precision Measurement=19; Combustion/Explosion R&D=20; Radiation Consultation=20; Radiation Monitoring=20; Nuclear=4; Trace Analysis=4, 9; Waste Disposal=9.

REVISED: Jul 82.

Section III

COMPANY KEYWORD INDEX

Section III

C O M P A N Y K E Y W O R D I N D E X

This section presents in alphabetical order all keywords previously documented in the company profiles of Section II. The keywords are listed in the left-hand column of the pages that follow. The subject categories, to which the keywords apply are listed in the middle column. The numerical code for these categories is explained as follows:

- | | |
|-------------------------------|----------------------------|
| 1. Aircraft | 11. Lasers |
| 2. Armament | 12. Machining |
| 3. Avionics | 13. Missiles |
| 4. Chemistry | 14. Protective Equipment |
| 5. Communications | 15. Radar |
| 6. Computers | 16. Security & Safety |
| 7. Electronics | 17. Software Services |
| 8. Energy | 18. Space Systems |
| 9. Environment | 19. Testing/Test Equipment |
| 10. Image Processing & Optics | 20. Miscellaneous |

The right-hand column of the company keyword index presents the three letter code for the company concerned. The reader is referred to Section IV of this report for an index of these company codes.



COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
A-3	4, 20	ECP
A-4	4, 20	ECP
A-5	4, 20	ECP
Abradable Seals	1, 4, 12	SGM
Acoustic Sensing	7	ATH
Acoustic Sensing	7, 20	CDC
Acoustic Sensing	7	SOC
Acoustics	9	EAG
Acoustoelectric Transducers	1, 19, 20	CTF
Active Sonobuoys	7, 20	SOC
Acylation	4	RAY
Adapters	5	CMC
Adaptive Receivers	5	MCS
Aerial Surveys	8, 9, 20	SPA
Aerial Target Tracking System	1	SED
Aerodynamics	1	CDR
Aeronautical Engineering	1	INA
Aerospace Parts	12	TEC
Ailerons	1	FLT
Air Analysis	9	PHV
Air Control Indicators	7, 20	DGI
Air Cushion Equipment Transporters	1	BAC
Air Cushion Systems	1	BAC
Air Cushion Vehicles	1	BAC
Air Cushion Vehicles	1	FLT
Air Defense Systems	20	CDC
Air Delivery Systems	1	DHC
Air Delivery Systems	1	IIC
Air Infiltration	9	FEI
Air Pollution	9	ARC
Air Quality	9	EAG
Air Traffic Control	1, 17	DMR
Air Traffic Control Communications Syst	5	GML
Air Traffic Control Communications Syst	5	JAT
Air Traffic Control Simulators	7, 20	DGI
Air Traffic Control Simulators	20	LSL
Air Traffic Control Systems	20	CAE
Air Traffic Control Systems	6, 20	CSG
Air Traffic Control Systems	20	GDS
Air Traffic Control Systems	6, 19	HIT
Air Traffic Control Systems	20	LSL
Air Traffic Control Systems	5, 20	PEL
Airborne Laser Fluorosensor	11	BRL
Airborne Surveys	9	BRL
Airborne Surveys	8, 9, 20	MAR
Aircraft Control	1	DHC
Airfoil	1, 3, 16	LEI
Airframe	1	CDR
Airframe Components	1, 12	AER
Airframe Components	1	BAL
Airframe Components	1	BOE
Airframe Components	1	CAP

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Airframe Components	1	DHC
Airframe Components	1	IMP
Airframe Structures	1	BAL
Airframe Structures	1	BOE
Airframe Structures	1	CAP
Airframe Structures	1	DHC
Airframe Structures	1	IMP
Airport Meteorological Systems	9, 20	GDS
Airport Status Systems	9, 20	GDS
Alarm Systems	5, 7	BCL
Alloys	1, 4, 12	SGM
Alternate Fuels Research	4	INR
Alternate Fuels Research	8	ORF
Alternate Fuels Research	1, 4	PWA
Aluminum	12	TEC
Aluminum Castings	12	SLA
Aluminum Components	1	CAP
Ambient Air Quality Assessment	9	ORF
Ammunition	2	IVI
Ammunition Smoke	2, 4	HFI
Amphibious Vehicles	20	GMC
Amplifier Subsystems	7, 18	VAR
Amplifiers	1, 5	PEP
Amplifiers	7	VAR
Analog	7	BEE
Analog	5	BNR
Analog	5	FEI
Analog	5, 20	RMS
Analog	5, 7	TIL
Analysis	9	PED
Analyzer	1, 14	NAT
Anechoic Chambers	19	RSL
Anemometer	7	DGI
Animated System Trainers	1, 19	AFR
Anode	4, 8	BRI
Antennas	7, 15	CAL
Antennas	3, 15	FLT
Antennas	7, 15	MPB
Antennas	3	NAT
Antennas	20	PEP
Antennas	5	SCS
Antennas	5, 18	SPA
Anti-Friction Bearings	1, 12, 20	FAG
Applications	6	FEI
Applications	11	ULI
Applied Physics	20	CTF
Applied Research	4, 8, 20	GTP
Arc Lamps	8	MPB
Arc Lamps	8, 9	VOR
Arctic Engineering	20	FGB
Armored Vehicles	20	GMC
Asbestos Measurement & Control	9, 16, 19	ORF

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Asbestos Processing	4	ORF
ASW	20	HEL
ASW	20	SOC
ASW System	1, 20	CDC
Atmospheric Monitoring	9	GDS
Atmospheric Optics	9, 10, 11	OPI
Atomic Absorption Spectrophotometers	4, 9	SCX
Audio	3, 5	NAT
Augmentor Wing	1	DHC
Automated Backplane Wiring	7	MAN
Automated Monitoring & Control Systems	5, 18	MCS
Automated Precision Measuring	12, 19	DIF
Automatic Weather Station	9	FEI
Automatic Measurement Systems	7, 17	CTF
Automatic Number Identification Systems	5	AEI
Automatic Test Equipment	7, 19	AMI
Automatic Vehicles Monitoring (AVM)	5, 20	RMS
Automation	20	TEK
Auxiliary Power Units	8	GTP
Auxiliary Power Units	8	PWA
Avalanche Detectors	7	FEI
Avionics Engineering	1, 3	INA
Avionics Programming	17	TIL
Ballast Transformers	20	PEL
Ballistic Computer Systems	20	CDC
Based Tone Signalling	5, 7	BCL
Bathymeter	1, 9, 11	OPI
Battery	4, 8	BRI
Beacons	1, 3, 16	GML
Beacons	5	HEL
Beacons	1, 3, 16	LEI
Beacons	5	SCS
Bearings	1, 12, 20	FAG
Belts	14	IIC
Beryllium Copper	12	TEC
Beta Ray Monitors	9, 14	SCX
Bias Insertion Units	7	AVT
Biology	20	ARC
Biomaterials & Bioengineering	8	ORF
Biomedical Instruments	20	CTF
Blister Packaging	20	INR
Bonded Components	1, 18	FLT
Bonded Honeycomb Assemblies	1	FLT
Bonding Wire & Ribbons	20	COM
Boring	12	DIE
Boundary Layer	9	EAG
Brass	12	TEC
Brushless DC Motors	20	PEP
Build To Print	7	MCS
Build To Print	7	SIM
Business Terminals	6	NOR
C-4	4, 20	ECF

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
C3 Systems	5	CAL
C3 Systems	7, 20	CDC
C3 Systems	5	FEI
C3 Systems	5	LSL
C3 Systems	17	NOR
C3 Systems	5, 6, 17	PDS
Cabinet Testing	7, 19	SIM
Cabinets	7	FLT
Cabinets	7	SIM
Cabinets	7	VAR
Cables	10	BNR
Cables	1, 7, 10	CWC
Cables	1, 7, 20	ITT
Cables	1	NAT
Calibration	19	CMC
Cargo Handling Equipment	1	CAP
Cargo Handling Equipment	1	DHC
Cartography	10	SYS
Castings	12	CDR
Castings	20	SGM
Castings	12	SLA
Castings	12	TEC
Cathode	4, 8	BRI
Cavity Enclosure	11	ULI
CCD Imaging Devices	10	BNR
Center-Loaded Antennas	5	SCS
Chains	12	GLF
Chemical Agent Detection	9, 16, 20	SCI
Chemical Airburst Simulators	2, 4	HFI
Chemical Dispersers	2, 4	HFI
Chemical Groundburst Simulators	2, 4	HFI
Chemical Processing	4	ARC
Chemical Spill Cleanup	9	DDG
Chips	7	CTC
Chips	7	PML
Circuit Layout	17	CGS
Circuit Packaging	7	CMC
Clandestine	5	NAT
Cleanup	9	DDG
Climatology	9	EAG
Closed Die	12	GLF
Cloud Dynamics	9	EAG
Cloud Physics	9	ARC
Cloud Physics	9	EAG
Cloud Seeding	9	ARC
CMOS	7	PML
CNC Machining	12	DIE
CO2	11	LUM
CO2 Lasers	11	MPB
CO2 Lasers	11	ULI
CO2 Optoacoustic Detector	11	ULI
Coal Liquefaction	8	ARC

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Coal Pyrolysis	8	ARC
Coating	12	BAL
Coating	12	UDT
Coating Specialized	12	EBC
Cobalt-Samarium Magnets	20	SGM
Cockpit Displays	3	CDC
Cockpit Displays	3	DHC
Cockpit Displays	3	GML
Cockpit Displays	3	LSL
Cockpit Displays	3	OPT
Cockpit Displays	1, 7	SUD
Cockpit Voice Recorders	19	AFR
Coils	7	MAN
Combustion Research	1, 4	PWA
Combustion Technology	8, 20	GTP
Combustion/Explosion R&D	20	WNR
Command & Control Systems	6, 17	IPS
Command Active Sonobuoys	7, 20	SOC
Communications	18	CAL
Communications	11	FEI
Communications	18	MCS
Communications	5, 6, 17	PDS
Communications	7, 10	PHD
Communications	5, 18	SPA
Communications	11	ULI
Communications Analysis	5, 18	MPB
Communications Software	5, 17	BNR
Communications Systems	5	NAT
Communications Systems	5	NOR
Communications Systems	5	SCS
Communications Systems	18	SED
Component Design	5, 7	MPR
Component Development	5, 7	MPR
Component Fabrication	1, 7	NWI
Component Parts	1	EXC
Component/System Testing	7, 19	EDS
Components	1	CDR
Components	3, 7, 5	CMC
Components	7	FEI
Components	1	FLT
Components	1, 12	MCL
Composite Components	1, 18, 20	BOE
Composite Components	1	CAP
Composite Components	1	CDR
Composite Components	1, 2, 20	CGE
Composite Components	1, 7, 15, 18	FLT
Composite Evaluation	1, 19, 20	CTF
Composite/Fiberglass Components	1	DHC
Composition B	4, 20	ECP
Compound Semiconductor Wafers	4, 7	COM
Computer Aided Dispatch (CAD)	5	RMS
Computer Aided Learning Systems	20	GDS

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Computer Communications	6	GDC
Computer Design	6	BNR
Computer Design	1, 17	CDR
Computer Design	6, 17	PDS
Computer Design	6	SCI
Computer Dispatch	6, 7	CSG
Computer Graphics	9	ARC
Computer Graphics	17	CAM
Computer Graphics	6, 7, 17	NOR
Computer Parts	6	CAL
Computer Parts	6	CDC
Computer Parts	6	SUD
Computer Produced Maps	6, 8, 9	SPA
Computer Security	16	IPS
Computer Simulation	5, 6, 15, 18	HIT
Computer Systems	3, 6	CDC
Computer Systems	6, 15, 19	HIT
Computer Systems	1, 6	NAT
Computer Systems	6, 18	SED
Computer Systems	5, 6	SYS
Computer Technology	6	BNR
Conceptual Application	20	WIL
Connectors	1, 7, 9, 20	ITT
Consulting	6	ACL
Consulting	17	DCI
Consulting	5, 6, 7, 15, 17, 18	DMR
Consulting	9	FGB
Consulting	5, 7	JAT
Consulting	6, 15, 17	PDS
Consulting	7	TIL
Consulting	5, 7	WSL
Contaminated Transformer Oil	9	DDG
Continuous Casting	12	SGM
Continuous Wave CO2	11	MPB
Continuous Wave CO2	11	ULI
Continuous Wave Lasers	11	MPB
Continuous Wave Light Sources	7	PRA
Contract Management	20	AMI
Contract Research	4, 8	BRI
Contract Research	7, 10, 11	PRA
Contract Research	4	RAY
Contract Research	4, 7, 9	SCI
Control Cables Fabrication	1	NWI
Control Circuitry	7	VAR
Control Heads	5	GEL
Control Systems	7	BEE
Control Systems	18, 20	CAE
Control Systems	6, 19	HIT
Control Systems	1	MCL
Control Systems	17	TIL
Controllers	7	EDS
Controllers	5	SYS

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Controls	1, 3, 5	NAT
Controls	9, 18	SPA
Convective Storms	9	ARC
Converter/Recorders Systems	5, 20	PEP
Convertors	1, 7, 9, 20	ITT
Copper	12	TEC
Copper Rod Products	20	CWC
Core Memory Arrays	7	SUD
Core Wound Products	7	SUD
Corona Testing	7, 19	HMC
Corrosion Control	1	IMP
Corrosion Control	1	INA
Couplers	10	PHD
Cowlings	1	FLT
Crash Position Indicator	3, 16	GML
Crash Position Indicator	3, 16	LEI
Cryogenic Liquid Containers	20	CTF
Cryogenics	7, 20	CTF
Crystals	7	PEL
Current/Pulse Capabilities	7	HMC
Custom	7	PML
Custom Circuits	5, 6, 7	EEL
Custom Design &Development	7	MAN
Custom Packaging	20	INR
Custom Research	4	WNR
Custom Synthesis	4	RAY
CW Agent Detection	9, 16, 20	SCI
DAMA	5, 18	MCS
Data Acquisition	7, 17	LSL
Data Acquisition	7, 9	ATH
Data Acquisition	1, 8, 18, 20	CAE
Data Acquisition	8, 9, 10, 15, 17, 20	CAM
Data Acquisition	1, 3, 7, 20	CDC
Data Acquisition	6, 7	CSG
Data Acquisition	17	DMR
Data Acquisition	6, 9, 19	FEI
Data Acquisition	17	GDS
Data Acquisition	18, 19	HIT
Data Acquisition	17	IPS
Data Acquisition	7, 20	JMR
Data Acquisition	16	LEI
Data Acquisition	18	MCS
Data Acquisition	17	NOR
Data Acquisition	1, 8, 9, 20	QSL
Data Acquisition	7	SIM
Data Acquisition	17	TIL
Data Analysis	7	BRL
Data Analysis	1, 3, 7	CDC
Data Analysis	1	DHC
Data Analysis	6, 9, 19	FEI
Data Analysis	3, 7	LSL
Data Analysis	1, 8, 9, 20	QSL

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
	3	OPT
Data Annotation Displays	6	HIT
Data Base	17	SYS
Data Base	7	BAL
Data Collection	7	EDS
Data Collection	5, 7	CMC
Data Communications	5	GDC
Data Communications	5	RMS
Data Communications	17	TIL
Data Communications	1, 8, 18, 20	CAE
Data Control Systems	1, 3, 7	CDC
Data Handling	1	DHC
Data Handling	6, 9, 19	FEI
Data Handling	1, 10, 18	MDA
Data Handling	10	OEL
Data Links	8, 9, 10, 15, 17, 20	CAM
Data Management	8, 9, 10, 15, 17, 20	CAM
Data Processing	17	DMR
Data Processing	6, 9, 19	FEI
Data Processing	17	GDS
Data Processing	17	IPS
Data Processing	16	LEI
Data Processing	3, 7, 17	LSL
Data Processing	18	MCS
Data Processing	17	NOR
Data Processing	7, 10	PHD
Data Recorder Systems	20	PEP
Data Reduction	18	CAL
Data Reduction	1, 8, 9, 20	QSL
Data Reduction	17	TIL
Data Terminals	7	AVT
DC Powered Modules	1	IIC
Deceleration Systems	9	DDG
Decontamination	4, 20	ECP
Demolition Block	9, 16	SEA
Desalination	6	CAL
Design	12	DIE
Design	7, 19	FEI
Design	3, 5, 15, 16	LEI
Design	11	ULI
Design	17	CAL
Design to Requirements	17	EDS
Design to Requirements	17	GDS
Design to Requirements	17	GML
Design to Requirements	17	IPS
Design to Requirements	17	SED
Design to Requirements	17	TIL
Design to Requirements	17	WNR
Design to Requirements	17	OEL
Detectors	7, 10	BRI
Development	4, 8	FEI
Development	19	LEI
Development	3, 5, 15, 16	

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Development	5, 6, 17, 20	TEK
Dewars	20	CTF
Diagnostic Chemicals	4	RAY
Die Fabrication	12	AER
Die Fabrication	12	BAL
Die Fabrication	12	DIE
Die Fabrication	12	EBC
Die Fabrication	12	EXC
Die Fabrication	12	NWI
Dielectric Testing	7, 19	HMC
Digital	7	BEE
Digital	5	BNR
Digital	8, 9, 17, 20	CAM
Digital	5	FEI
Digital	5	GDC
Digital	1, 7, 15, 18	MDA
Digital	7	MPB
Digital	5	MPR
Digital	5, 20	RMS
Digital	5	TEK
Digital	5, 7	TIL
Digital Communications	18	MCS
Digital Data Processing	9, 15	ARC
Digital Image Analysis	7, 10, 18	DIP
Digital Mapping	8, 9	SPA
Digital Modems	5	MCS
Digital Order Wire	5	CMC
Digital Squid Control Module	16	CTF
Digital Switches	15	SED
Digital Switching Systems	5	MPR
Digital to Photo Data Reduction	18	IMA
Digital to Photo Processing	7, 10	IMA
Digitizing Scanners	10	IMA
Dispersion Modeling	9	EAG
Dispersion Strength Alloys	1, 4, 12	SGM
Display Technologies	7	OPT
Displays	1, 3	CMC
Displays	3, 7	DII
Displays	17	IPS
Displays	7	MPB
Distillers	9	SEA
Distributions Systems	5, 10	BNR
Dive Support Instruments	20	CTF
DME (Ground Based)	3, 20	PEL
Doors	1	FLT
Doppler Navigation Systems	3	CMC
Doppler Survey Receivers	7, 18	JMR
Dosimeters	9, 14	SCX
Double Base Propellants	4, 20	ECP
Drafting	6	SYS
Drone Recovery Systems	1	IIC
Drones	1	CDR

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Drones	1	DHC
Drugs Detection	20	SCI
ECCM Radio	5	CMC
Elastomers	4	RAY
Electrical Engineering	1, 7	INA
Electrical System	1	NAT
Electro-Mechanics	7	IMA
Electro-Optical Instrumentation	7, 10, 19	PRA
Electro-Optics	10	BRL
Electro-Optics	10	IMA
Electro-Optics	7, 10	OEL
Electro-Optics	10	OPI
Electrochromic Technology	7	OPT
Electrolyte Cell Separators	4	RAY
Electromagnetic Compatibility	3, 19	IMP
Electromagnetics	1, 9, 15, 20	MPB
Electromagnetics	7, 8	SCX
Electromechanical Design	19	CAL
Electronic Test Equipment	19	OPT
Electronic Warfare	7	CAL
Electronic Warfare	5, 7	MCS
Electronic Warfare	6, 17	PDS
Electronics	19	VIC
Electronics Design	7	SCI
Electronics Parts	12	TEC
Emergency Locator Beacons	3, 16	GML
EMP Shielding	14	RSL
Energy Conversion	8	ENC
Energy from Biomass	8	ORF
Energy Management	8, 17	SYS
Engine Component Simulator	19	AFR
Engine Components	1	BAL
Engine Components	1	DHC
Engine Components	1	PWA
Engine Components	1	SGM
Engine Components	1	SPA
Engine Controls	1	CDC
Engine Controls	1	DHC
Engine Emission Research	1, 9	PWA
Engine Fairings	1	FLT
Engine Instruments	1, 3	CMC
Engine Nacelles	1	FLT
Engine Research	1, 8	PWA
Engine Systems	1	BAL
Engine Systems	1	DHC
Engine Systems	1	PWA
Engine Systems	1	SGM
Engine Thrust Measuring Device	1	CDC
Engineering Consultation	6, 17	PDS
Engines	1	PWA
Engraving	12	NAT
Environmental Analysis	9	ATH

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Environmental Analysis	9	BRL
Environmental Analysis	9	MAK
Environmental Analysis	9	PEP
Environmental Analysis	9	WNR
Environmental Assessment	9	EAG
Environmental Controls	9	DDG
Environmental Controls	1	DHC
Environmental Controls	1	GML
Environmental Forecasting	9	ATH
Environmental Instruments	1	GML
Environmental Laboratory	19	HEL
Environmental Programming	17	TIL
Environmental Programs	17	ATH
Environmental Programs	9	WNR
Environmental Sensors	7, 9	ATH
Environmental Sensors	9	CTC
Environmental Sensors	7	INR
Environmental Sensors	7	SOC
Environmental Testing	19	CAL
Evaporation	9	SEA
Evaporation Charges	4	COM
Excimer Lasers	11	LUM
Explosafe	1, 14, 16, 20	EXP
Explosion Suppression Systems	1, 14, 16, 20	EXP
Explosives Detection	16	SCI
Extended Interaction Klystrons	7	VAR
Extended Length	12	CDR
Extended Length	12	DHC
Extended Length	12	EBC
Extrusion Tooling	12	EXC
Fabrication	12	DIE
Fabrication/Assembly/Test	7	MAN
Facility Management	20	IPS
Far Infrared	11	MPB
Fast Optical Detection	7, 10	OEL
Fast Optical Sources	7, 10	OEL
Feasibility Studies	6, 17	IPS
Feasibility Studies	17	PDS
FETs	7	OPT
Fiber Optic Cable	10	CWC
Fiber Optic Components	5, 10	BNR
Fiber Optic Components	10	CWC
Fiber Optic Products	7, 10	PHD
Fiber Optic Systems	10	OEL
Fiber Optic Transmission System	5, 10	BNR
Fiber Optics	5, 10	BNR
Fiber Optics	5, 7	FEI
Fiber Optics	10	IMA
Fiber Optics	10	NAT
Fiber Optics	7	PEL
Fiber Optics	5, 10, 19	PHD
Fiberglass Components	1, 18, 20	BOE

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Fiberglass Composite Component Manuf.	1	NWI
Film Annotation Systems	1	PEP
Film Recorders	10	IMA
Filters	7	PML
Financial	17	SYS
Fire & Flammability Measurements	16, 19	ORF
Fire Control System	20	CDC
Fire Support Vehicle	14, 20	GMC
Firmware Design	6	ACL
Fixed	5	SCS
Flaps	1	FLT
Flares	2, 4	HFI
Flat Panel Displays	3, 7	OPT
Flaw Detection	10, 19	DIF
Flight Control Systems	1	MCL
Flight Data Recorders	19	AFR
Flight Data Recorders	1, 3	CDC
Flight Data Recorders	1, 3	LEI
Flight Data Recorders	1	PEP
Flight Information Display Systems	7, 17, 20	GDS
Flight Operations	1, 6	MDA
Flight Recorder	1	NAT
Flight Simulators	1, 3	CAE
Flight Surface Manufacture	1	NWI
Flocculation Studies	4	RAY
Flood Forecasting	9	ARC
Fluid Dynamics	20	SCI
Flutter Analysis	19	CDR
Forgings	12	CDR
Forgings	12	GLF
Forgings	12	SLA
Forgings	12	TEC
Fracture Analysis	19	CDR
Fuel Research	1	DHC
Fuel Storage Systems	20	UTD
Fuel Systems	1	DHC
Fuel Systems Research	1	PWA
Fuels Research	1, 4	PWA
Fusion Splicers	7	FEI
Gamma Ray Monitors	9, 14	SCX
Gas Chromatography	9	PHV
Gas Analysis	9	PHV
Gas Lasers	11	LUM
Gas Turbine Components	1	BAL
Gauges	12	DIE
Gear Boxes	1, 19	BAL
Gear Boxes	1, 19, 20	SPA
Gear Inspection	10, 19	DIF
General Chemistry	4	WNR
General Testing	19	IMP
Generators	8	GTP
Geochemical Equipment	8	SCX

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Geographic Analysis	8, 9, 17, 20	CAM
Geographic Analysis	17	FGB
Geographic Information Systems	8, 9, 17, 20	CAM
Geographic/Geologic Analysis	17	BRL
Geologic Analysis	8, 9, 17, 20	CAM
Geologic Analysis	17	FGB
Geology	8, 9	ARC
Geophones	7, 8	ATH
Geophysical Equipment	8	SCX
Geophysical Sensors	9, 19	PED
Geophysics	7, 8	ATH
Geophysics	7	INR
Geophysics	7	SOC
GP Armored Vehicles	20	GMC
Gradiometers	16	CTF
Graphics	17	CSG
Graphics	17	IPS
Graphics	7	MPB
Graphics	7, 17	NOR
Graphics	6, 17	PDS
Graphics Display	17	IMA
Graphics Display	17	NOR
Graphite Avionics Doors	1	FLT
Graphite Epoxy Components	1, 18, 20	BOE
Gravity	8	SCX
Green Signal Smoke	2, 4	HFI
Grenades Smoke	2, 4	HFI
Ground Based Reproducers	5, 20	PEP
Ground Control Equipment	18	SED
Ground Positioning	7, 18	JMR
Ground Station Antennas	18	VIC
Ground Stations	18	CAL
Ground Stations	17, 18	DMR
Ground Stations	18	FEI
Ground Stations	7, 18	MCS
Ground Stations	18	MDA
Ground Stations	7, 18	SED
Ground Stations	5, 18	SPA
Ground Steering Systems	1	MCL
Ground Transportation	20	GMC
Ground Transportation	20	UTD
Ground Water	8, 9	ARC
Halogenation	4	RAY
Hand Grenades Smoke	2, 4	HFI
Hardware	5, 6	TEK
Hardware Development	7, 10, 18	DIP
Hardware Evaluation	6	IPS
Hardware Procurement	6, 17	PDS
Harnesses	14	IIC
Harnesses	1, 7, 20	ITT
Harnesses	1	NAT
Harnesses	7	SUD

COMPANY KEYWORD INDEX

<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
Hazardous Gas Alarm System	9	INR
Hazardous Gas Detection	9	BRL
Hazardous Gas Detection	4	INR
Hazardous Gas Detection	9	MPB
Hazardous Gas Detection	9	ULI
Hazardous Gas Detectors	9	SCX
HC Smoke	2, 4	HFI
Heat Exchangers	20	FLT
Heat Treating	12	BAL
Heat Treating	12	CDR
Heat Treating	12	EBC
Heat Treating	12	EXC
Heat Treating	12	UDT
Helicopter Air Data Systems	3	DGI
Helicopter Blade Subassemblies	1	FLT
Helicopter Heater Systems	1	CCA
Helicopter R&O	1	INA
Helicopter Subsystems	1, 19	BAL
Helicopter Subsystems	1	CAP
Helicopter Subsystems	1	SPA
Helicopter Systems	1	MCL
Helicopter Systems	1	PWA
Helicopter Wire Strike	1, 14	BAL
Helicopters	1	NAT
Helium Neon Lasers	11	PRA
HF Adaptive Antenna Arrays	5, 7	MCS
HF Antennas	5	HEL
HF Communications	5	MCS
HF Modems	5	GEL
HF Modems	5, 7, 17, 18	MCS
HF Radio Data Systems	5	GEL
HF Radios	5	SCS
HF Transceivers	19	AFR
HF Whip Antennas	5	SCS
High Energy	2, 4, 20	ECP
High Energy Density	4, 8	BRI
High Explosives	4, 20	ECP
High Intensity Light	8	MPB
High Intensity Light	8	VOR
High Purity Metals	4	COM
High Speed Pulsers	7	AVT
High Voltage Pulse Techniques	7	OEL
High Voltage Transformers	7, 15, 19	HMC
High Volume Smoke Pot	2, 4	HFI
Hybrid Assembly	7	MAN
Hybrid Circuits	5, 6, 7	EEL
Hybrid Mobile Protected Weapon System	2	GMC
Hydraulic Assembly	12	EBC
Hydraulic Servos	1, 12	AER
Hydraulics	1	BAL
Hydraulics	1	DHC
Hydraulics	1	HER

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Hydraulics	19	NWI
Hydraulics	20	WIL
Hydrocarbons	4	RAY
Hydrogen	4, 9	INR
Hydrogen Gas Detection	9	INR
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Hydrogen Storage Systems	20	UTD
Hydrogen/Fuel Storage Systems	8, 20	WNR
Hydrologic Analysis	8, 9, 17, 20	CAM
Hydrologic Mapping	8, 9, 17, 20	CAM
Hydrological Systems	9	GDS
Hydrometeorology	9	ARC
Hydrophones	7, 20	SOC
IC Design	7	PML
Ice Detector	3, 16	LEI
Ice Measurement	7	DGI
Ice Mechanics	9, 20	FGB
Icing	9	EAG
Igniters	2, 4	HFI
Illuminated Panels	1, 3	CMC
Illumination	1	NAT
Illumination Signals Smoke	2, 4	HFI
ILS	1, 3, 20	AMI
ILS (Ground Based)	3, 20	PEL
Image Processing	6, 10	ACL
Image Processing	5, 10	BNR
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Image Processing	10	IMA
Image Processing	9, 10, 15, 18	MDA
Image Processing	10	NOR
Image Recorder	1, 7, 10, 18	MDA
Impedance Transformers	7	AVT
Impulse Generators	7	AVT
IMTS Terminals	5	GEL
Industrial Control Instrumentation	7, 10	OEL
Industrial Engineering	20	ARC
Inertial Navigation	3, 7	LSL
Inflatable Life Support Systems	1, 14	IIC
Information Displays	17	IPS
Information Handling Products	7	SUD
Information Systems	6, 17	NOR
Infrared	20	WIL
Infrared Instrumentation	7	BRL
Infrared Instrumentation	7	OEL
Infrared Instrumentation	7	OPT
Infrared Instrumentation	7, 10, 18, 20	SPA
Infrared Materials	7	COM
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Injection Molding	2, 12	CGE
Injection Molding	12	CAC
Injection Molding	12	CAC

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Injection Molding	12	INR
Injection Molding Tools	12	KOS
Inorganic	4	ENC
Inspection Equipment	10	DIF
Installations & Servicing	3, 7	NWI
Instrument Bearings	12, 20	FAG
Instrument Manufacture	7	BRL
Instrument Repair	1	NWI
Instrument Servicing	1	NWI
Instrumentation	9, 19	ATH
Instrumentation	7, 19	BAL
Instrumentation	7	CWC
Instrumentation	3, 7, 20	DGI
Instrumentation	7	EEL
Instrumentation	6, 9, 19	FEI
Instrumentation	19	LSL
Instrumentation	7, 8, 9	MPB
Instrumentation	7, 10	OEL
Instrumentation	18	SED
Instrumentation	19	WNR
Instrumentation (Air/Gas)	19	PHV
Instruments	1, 3	CDC
Instruments	1	DHC
Instruments	1, 3	LSL
Instruments	1	NAT
Instruments	1	PEP
Instruments	4	SCI
Integrated Circuits	7	PML
Integrated Data Acquisition Systems	7, 20	JMR
Integrated High Density LED Displays	3, 7	OPT
Integrated Logistic Support	1, 3, 20	AMI
Integrated Marine Navigation Systems	7	JMR
Integrated Processing & Display Systems	17, 20	SUD
Intelligent Instruments	1, 3	CMC
Interactive Analysis	9, 10, 18	MDA
Interactive Processing	17	CAM
Intercom	5	LEI
Intercom	5	NAT
Interface	3	NAT
Interface Systems	5	IPS
Interfacing	5	TIL
Intrusion Detection	16	CDC
Intrusion Detection	16	LSL
Inverting Transformers	7	AVT
Iodine Lasers	11	MPB
Ion Molecule Chemistry	4	SCI
Ion Physics	9, 20	SCI
ISC-CMOS (tm)	7	PML
Isotopic	11	ULI
Jamming	5	MCS
Jig Fabrication	12	CAP

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Klystrons	7	VAR
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Laboratory	19	FEI
Laminates	1, 18, 20	BOE
Landing Gear Components	1, 12	AER
Landing Gear Components	1, 12	MCL
Landing Gear Steering Systems	1	SIM
Landing Gears	1	DHC
Landing Gears	1	HER
Landing Gears	1	MCL
Landsat	18	MDA
Landsat Imagery	10	IMA
Large Caliber Casings	2	IVI
Large Scale Integrated Circuits	7	MPR
Laser Communications	11, 18	MPB
Laser Diode Sources	11	OEL
Laser Diodes	7, 11	FEI
Laser Film Image Recorder	1, 7, 10, 11, 18	MDA
Laser Light Sources	11	OEL
Laser Optics	11	ATH
Laser Optics	10, 11, 19	DIF
Lasers	5, 11	FEI
Lasers	11	LUM
Launch Tubes	2	CGE
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Leak Detection	9, 19	ATH
Leak Detection	7, 19	HMC
LED Arrays	3, 7	OPT
LED Displays	7	LSL
LED Materials	7	OPT
LEDs	7	FEI
LEDs	10	NAT
Level of Repair Analysis	20	AMI
Lidar	8, 9, 11	OPI
Life Cycle Support	20	PDS
Life Cycle Support	1, 20	SPA
Light Analysis	7	PRA
Light Armored Vehicles	20	GMC
Light Detection	7	PRA
Light Generation	7	PRA
Lighted Panels	1, 10	NAT
Lighting	7, 20	CWC
Line Terminating Unit	5	CMC
Linear Power Supplies	7	ANA
Linear Pulse Amplifiers	7	AVT
Liquid Crystal Displays	3, 7	DII
Liquid Crystals	7	OPT
Lithium Batteries	4, 8	BRI
Locomotives	20	GMC
Logistic Support Analysis	20	AMI
Long Range Transport	9	EAG

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Low Voltage Transformers	7	HMC
LSIC	5, 7	BNR
Luminescence Decay Systems	7	PRA
Machining Design	12	EXC
Magnesium	12	TEC
Magnet Wire	7	CWC
Magnetic	8	SCX
Magnetic Anomaly Detection	3, 16	CAE
Magnetic Anomaly Detection	3, 16	CTF
Magnetic Anomaly Detection	16	PEP
Magnetic Devices	7	CMC
Magnetic Devices	7	HMC
Magnetic Tape Transports	7	SUD
Magnetometers	16	CTF
Magnetometers	9	PEP
Magnetometers	8, 9	QSL
Magnets	20	SGM
Maintenance	1	INA
Maintenance	17	PDS
Maintenance Consoles	7	SUD
Maintenance Recovery Vehicle	20	GMC
Manufacturing	20	FCP
Manufacturing	7	FEI
Manufacturing	2	IVI
Manufacturing	3, 5, 15, 16	LEI
Mapping	8, 9, 10, 15, 17, 20	CAM
Mapping	9	FGB
Mapping	8, 9, 20	MAR
Mapping	8, 9	QSL
Mapping	8, 9	SPA
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Martini (Dry)	8, 9, 20	GIN
Mass Spectrometry	4, 9, 16	SCI
Material Handling	9	DDG
Materials Testing	19	ARC
Measurement & Control Systems	7, 19	DIF
Measurement & Control Systems	7	DMR
Measurement & Control Systems	3	GML
Measurement & Control Systems	7	IPS
Measurement & Control Systems	7	SUD
Measurement Systems	7	BEE
Measurement Systems	7, 10	OEL
Mechanical Arms	8, 18, 20	SPA
Mechanical Assembly	12	EBC
Mechanical Mounts	7, 12	HMC
Medevac Kits	1	FLT
Medical Electronics	7	CWC
Medical Instrumentation	7	CWC
Memory	7	PML
Metal Detection	7	BRL
Metal Evaluation	19	CTF

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Metal Plating	8, 9, 10	VOR
Metal Recovery	9	DDG
Metal Working	12	BAL
Metallurgy	4	COM
Metallurgy	4	CTC
Metallurgy	4	WIL
Metallurgy	12, 19	WNR
Metals Glass & Ceramics	19	ORF
Metalworking	12	EBC
Metalworking	12	UDT
Meteorological Equipment	9, 20	ATH
Meteorological Instruments	9, 20	GDS
Meteorological Satellite Processing Sys	9, 10, 18	MDA
Meteorological Stations	9, 20	ATH
Meteorological Stations	9	BAL
Meteorological Stations	9, 20	GDS
Meteorology	15	ARC
Meteorology	9	EAG
Microbiological & Biochemical Processes	9	ORF
Microbiology	20	ARC
Microcircuits	5, 6, 7	EEL
Microcomputers	6	SUD
Microelectronics	7	CMC
Microelectronics	7	CTC
Microelectronics	7	MPR
Micrometeorology	9	EAG
Microprocessor Technology	6, 7	EDS
Microprocessor Technology	6, 17	IMA
Microprocessors	6, 7	BCL
Microprocessors	6, 7	CAL
Microprocessors	6, 7, 20	CTF
Microprocessors	6, 7	FEI
Microprocessors	6	NOR
Microprocessors	7	TIL
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Microwave Components	5, 18, 20	SPA
Microwave Systems	5	BCL
Microwave Systems	5	MPR
Millimeter Wave Subsystems	7	VAR
Milling	12	DIE
Mine Components	7	EEL
Miniature Bearings	12, 20	FAG
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Missile Parts	12, 13	AER
Mobile Communications	5	GEL
Mobile Communications	5	SCS
Mobile Control Heads	5	BCL
Mobile Data Design	5, 6, 17, 20	TEK
Mobile Laboratory Based Analytical Svc	4, 9, 20	SCI
Mobile Recovery System	9	DDG
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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Modems	5	GDC
Modems	5	GEL
Modems	5, 7, 17, 18	MCS
Modems	5, 7, 10	PHD
Modems	5	RMS
Modification	1	CAP
Modification	1	INA
Modulation Systems	5	MPR
Module Design	17	PDS
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Monitoring Systems	9	ATH
Monitoring Systems	7	BEE
Monitoring Systems	17	TIL
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Monocycle Generators	7	AVT
Monomers	4	RAY
Motors	20	PEP
Multi-Layered Board Assemblies	7	SUD
Multicolor LED Displays	3, 7	OPT
Multiplex Displays	3, 7	DII
Multiplexers	5	CMC
Multiplexers	5	GDC
Multiplexers	5	MPR
Multiprocessor Systems	6	ACL
Mutagenic Testing	19	ORF
Nanosecond	7	AVT
National Solar Test Facility	8	ORF
Natural Products	4	RAY
Navigation	7	CAL
Navigation	1, 3, 15	CDC
Navigation	3	CMC
Navigation	7, 20	DGI
Navigation	1	DHC
Navigation	7, 18	JMR
Navigation	3, 7	LSL
Navigation	7, 18	MCS
Navigation	1	PEP
Navigation	15	SUD
Navigation (Ground Based)	3, 20	PEL
Navigational Aids	5	SCS
Navstar/GPS	3	CMC
Network Systems	5	TIL
Nickel	12	TEC
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Nitrocellulose	4, 20	ECP
Noise	5	NAT
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Non-Destructive Testing	1, 19	BAL
Non-Destructive Testing	1, 19	IMP
Non-Destructive Testing	1, 19	INA

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Non-Destructive Testing	19	WNR
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Non-Routine Analysis	4	RAY
Nuclear	4	WNR
Nuclear Instrumentation	9, 19	PED
Nuclear Instrumentation	8	WNR
Nuclear Reactor Components	8	BAL
Nuclear Reactors	8	WNR
Nuclear Sensors	9, 19	PED
Nuclear Simulation	8	WNR
Nucleosides	4	RAY
Numerical Analysis	17	CAM
Numerical Modelling	9, 17	ARC
Off-Highway Vehicles	20	GMC
Office Automation	6, 20	SYS
Office Of The Future	6, 20	BNR
Oil Filling	7	HMC
Oil Sands	8	ARC
Oil Vacuum Processing	7	HMC
Omega Navigation Systems	3	CMC
Optical	5	FEI
Optical Building Blocks	7, 10	PRA
Optical Communications	5, 7	OEL
Optical Processing	10	VOR
Optics	10, 19	DIF
Optoacoustic Trace Gas Analyzer	9, 11	ULI
Orange Signal Smoke	2, 4	HFI
Ordnance	2, 4	HFI
Ordnance	2	IVI
Ordnance Detectors	4, 9, 14	SCX
Ordnance Impact Position	19	ATH
Ordnance Inspection Equipment	10	DIF
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Painting	1	INA
Panels	1	FLT
Panels	1, 10	NAT
Parachutes	1, 14	IIC
Parts	12	UDT
Passive Sonobuoys	7, 20	SOC
Payload Design	18	SED
Payload Test Services	18	SED
PC Board Design	7	ANA
PC Board Design	7	CGS
PC Board Design	17	DCI
PC Board Design	7	PED
PC Board Design	7	SUD
PC Board Design & Fabrication	5, 6, 7	EEL
PC Board Design & Fabrication	7	GML
PC Board Fabrication	17	DCI
PC Board Fabrication	7	PED
PC Board Fabrication	7	SIM

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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PC Boards	7	CMC
PC Boards	7	EDS
PC Boards	7	FEI
PC Boards	7	HEL
PC Boards	7	MAN
PCB Destruction	9	DDG
Performance Measuring Devices	1	CDC
Performance Measuring Devices	1	DHC
Peripheral Equipment	5	AEI
Peripheral Vision Display	3	GML
Personnel Carrier	20	GMC
Personnel Restraint Equipment	1, 14, 20	IIC
Personnel Survival Equipment	1, 14	IIC
Personnel Survival/Restraint	1	DHC
Petroleum Chemistry	4	RAY
Pharmaceutical Chemistry	4	RAY
Phased Array	15	CAL
Phased Array	15	FEI
Pheromones	4	RAY
Phosgenation	4	RAY
Photo-Fabrication	20	NAT
Photoacoustics	11	ULI
Photocatalyst	4	INR
Photochemistry	4, 8, 11	ENC
Photodetectors	10	OEL
Photogrammetry	10	CMC
Photogrammetry	1	PEP
Photogrammetry	10	SYS
Photographic Hard Copy	10	IMA
Photon Counting Systems	7	PRA
Photophysics	8, 11	ENC
Photoplatting	7	CMC
Photovoltaics	8	ORF
Physical Chemistry	4	RAY
Piezo-Electric Crystals	7	PEL
Pilot Plant Operations	4, 8	BRI
Plasma Arc	8	VOR
Plastic Fabrication	12	NAT
Plastic Fabrication	12	VIC
Plastic Fittings	20	CWC
Plastic Molding	12	MAN
Plastic Pipe	7, 20	CWC
Plastics	12	TEC
Pneumatics	20	WIL
Pollution	8, 9	QSL
Pollution Analysis	9	ATH
Pollution Control	9	DDG
Pollution Control	9	WNR
Pollution Detection	9	ULI
Pollution Monitoring	9	EAG
Pollution Sensing	9, 19	ATH

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Pollution Sensing & Analysis	9	MPB
Pollution Sensing & Analysis	9	WNR
Polyolithic Crystal Filters	7	MPR
Polymer Chemistry	4	RAY
Porous Titania Glass	4	INR
Portable Antenna Masts (Surface)	18	VIC
Portable Shelters	1, 20	FGB
Portable Terminals	7	EDS
Powder Metallurgy	4, 12	SGM
Power Amplifiers	7	VAR
Power Converters	7	GEL
Power Klystrons	7	VAR
Power Measurement	7	FEI
Power Splitters	7	AVT
Power Supplies	7	ANA
Power Supplies	1, 7, 13	CMC
Power Supplies	7	GEL
Power Supplies	7	GML
Power Supplies	5, 7, 8	GTP
Power Supplies	5, 7	MPR
Power Supplies	7	PED
Power Supplies	7	PEP
Power Supplies	6, 7	SOC
Power Supplies	7	SUD
Power Supplies	11	ULI
Power Supplies	7	VAR
Practice Bomb Signal Cartridges	2, 4	HFI
Pre-Wired Board Assemblies	7	SUD
Precious Metal Recovery	9	DDG
Precipitation Measurement	9, 15, 18	ARC
Precision Bearings	1, 12, 20	FAG
Precision Casting	12	FIT
Precision Casting	12	IMP
Precision Casting	12	SGM
Precision Engraving	12	INR
Precision Forging	12	GLF
Precision Machining	12	CMC
Precision Machining	12	DIE
Precision Machining	12	EBC
Precision Machining	12	EXC
Precision Machining	12	INR
Precision Machining	12	KOS
Precision Machining	12	TEC
Precision Machining	12	UDT
Precision Measuring	12, 19	DIF
Precision Measuring	19	WNR
Precision Opening Release Systems	1	IIC
Primary Batteries	4, 8	BRI
Printed Wiring Card	7	MAN
Process Control	6	FEI
Process Control	7, 10	PHD

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Process Development	9	DDG
Product Characterization	4	SCI
Product Equipment & Machinery D&D	12	ORF
Production Equipment	4, 8	BRI
Products Testing	19	ARC
Professional Services	4, 6, 7, 9, 16, 20	SCI
Programming	6	FEI
Programming	17	TIL
Project Development	17	PDS
Project Management	20	AMI
Project Management	6, 17	IPS
Project Management	5, 7	WSL
Projected Map Displays	1, 20	CDC
Propellants	4, 20	ECP
Protective Clothing	14	IIC
Proton Magnetometers	9	PEP
Proximity Beacon	7, 20	GEL
Pulse Amplifiers	7	AVT
Pulse Generators	7	AVT
Pulsed Gas Lasers	11	LUM
Pulsed Light Sources	7	PRA
Pulsers	7	VAR
Pumps	9	SEA
Pyrotechnics	2, 4	HPI
Pyrotechnics	1, 4, 16	VIC
Quality Assurance	20	SCI
Quartz Crystals	7	PEL
Radar	15, 18	CAL
Radar	15, 17	DMR
Radar	6, 15, 17	PDS
Radar	15	ULI
Radar Control Systems	6, 17	IPS
Radar Meteorology	9	EAG
Radar Simulation	15, 17	DMR
Radar System Engineering	15	HIT
Radiation Consultation	20	WNR
Radiation Measurements	14, 19	ORF
Radiation Monitoring	20	WNR
Radiation Monitoring Systems	9, 14	SCX
Radio	5	CMC
Radio	5	FEI
Radio	5	GDC
Radio	5, 7	JAT
Radio	5	MPR
Radio	5, 7	WSL
Radio Ancillaries	5	CMC
Radio Communication Gear, Fixed, Mobile	5, 5	GML
Radio Communications	5, 18	MCS
Radio Communications	5	SED
Radio Controls	20	RMS
Radio Modems	5	RMS

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Radio Wire Integrator	5	CMC
Radio/Radar Altimeters	19	AFR
Radiotelephone	5	GEL
Radiotelephone Equipment	5	SCS
Range Finder	8, 9, 20	OPI
Range Instrumentation	19	ATH
Rare Earth Magnets	4	INR
Rare Earth Magnets	20	SGM
RDX	4, 20	ECP
Real Time	6	FEI
Real Time	6	HIT
Real Time Graphics	17	CSG
Real-Time Control Systems	17	IPS
Real-Time Monitor Systems	17	IPS
Receivers	5	FEI
Recorders	7	DGI
Recording Seismographs	7, 8	ATH
Recovery Systems	1, 13, 18	IIC
Recycling	9	DDG
Red Signal Smoke	2, 4	HFI
Reed Capsule	20	MAN
Reflex Klystrons	7	VAR
Regulators	7	CDC
Relays	7	MAN
Remote Gas Detection	9	BRL
Remote Manipulator Systems	8, 18, 20	SPA
Remote Piloted Vehicles (RPV)	20	RMS
Remote Power Supplies	5, 7, 8	GTP
Remote Sensing	9	BRL
Remote Sensing	18	CAL
Remote Sensing	9	FGB
Remote Sensing	8, 9	MAR
Remote Sensing	1, 18	MDA
Remote Sensing	1, 8, 9, 20	QSL
Remote Sensing	9	SCX
Remote Sensing	7, 18, 20	SPA
Remote Sensing	9	ULI
Repair & Overhaul	1	BAL
Repair & Overhaul	3, 7	CAE
Repair & Overhaul	1	CAP
Repair & Overhaul	1	CCA
Repair & Overhaul	3, 6, 7	CDC
Repair & Overhaul	3, 7, 19	CMC
Repair & Overhaul	1	DHC
Repair & Overhaul	7	GDS
Repair & Overhaul	3	GML
Repair & Overhaul	1	HER
Repair & Overhaul	1	IMP
Repair & Overhaul	1	INA
Repair & Overhaul	3	LEI
Repair & Overhaul	3, 7	LSL

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Repair & Overhaul	3	NAT
Repair & Overhaul	1, 3, 7	NWI
Repair & Overhaul	1	PWA
Repair & Overhaul	1, 3, 7, 9	SPA
Repair & Overhaul	7	SUD
Repair & Overhaul (Sonar)	20	FLT
Repair Capability	12	EBC
Requirements Analysis	17	PDS
Research	4, 8	BRI
Research	4, 8, 20	ENC
Research	2	IVI
Research & Development	5, 7	JAT
Research & Development	6, 7	SCI
Retrofill	9	DDG
Reverse Osmosis	9	SEA
RF Shielding	14	RSL
Risk Analysis	9, 20	FGB
Rivetless Chains	12	GLF
Robotics	20	BNR
Rocket Propellant	2, 9	BAL
Rocket Engines	2, 9	BAL
Rocket Igniters	2, 4	HFI
Rocket Motor Casings	2	CGE
Rocket Nozzles	2	CGE
Rocket Subcommutators	20	PEP
Rockets	2, 9	BAL
Roller Bearings	1	PWA
ROM	1	CDR
Router Assemblies	1	FLT
Sandwich Components	1, 18, 20	BOE
SAR	1, 15, 18	MDA
Satellite Communications	5, 18	MCS
Satellite Communications	11, 18	MPB
Satellite Communications Ground Stations	18	SED
Satellite Communications Power Amps	7	VAR
Satellite Communications Systems	5, 18	MPR
Satellite Electronics	18	CAL
Satellite Meteorology	9	EAG
Satellite Radar Rain Forecasting System	9, 18, 20	GDS
Satellite Subsystems	18	GDS
Satellite Subsystems	5, 18	SPA
Satellite Telemetry Tracking Stations	18	SED
Satellite Weather Forecasting	9, 18, 20	GDS
Satellites	18	FLT
Satellites	5, 18	SPA
SCADA Equipment	5, 20	RMS
Scope Probes	7	AVT
SCPC	5, 18	MCS
Sealed CO2	11	ULI
Sealed-Off Lasers	11	MPB
Search & Rescue	18	CAL

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<u>Keyword</u>	<u>Category</u>	<u>Company Code</u>
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Secondary Batteries	4, 8	BRI
Secure	5	FEI
Seismic Sensors	7, 9	FEI
Selective Signalling	5	GEL
Semiconductor Wafers	4, 7	COM
Semiconductors	4, 7	COM
Semiconductors	7	CTC
Semiconductors	7	OPT
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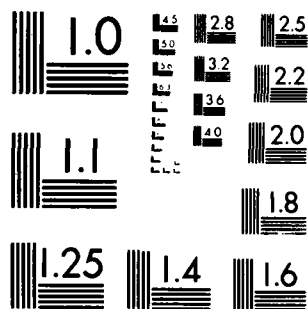
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